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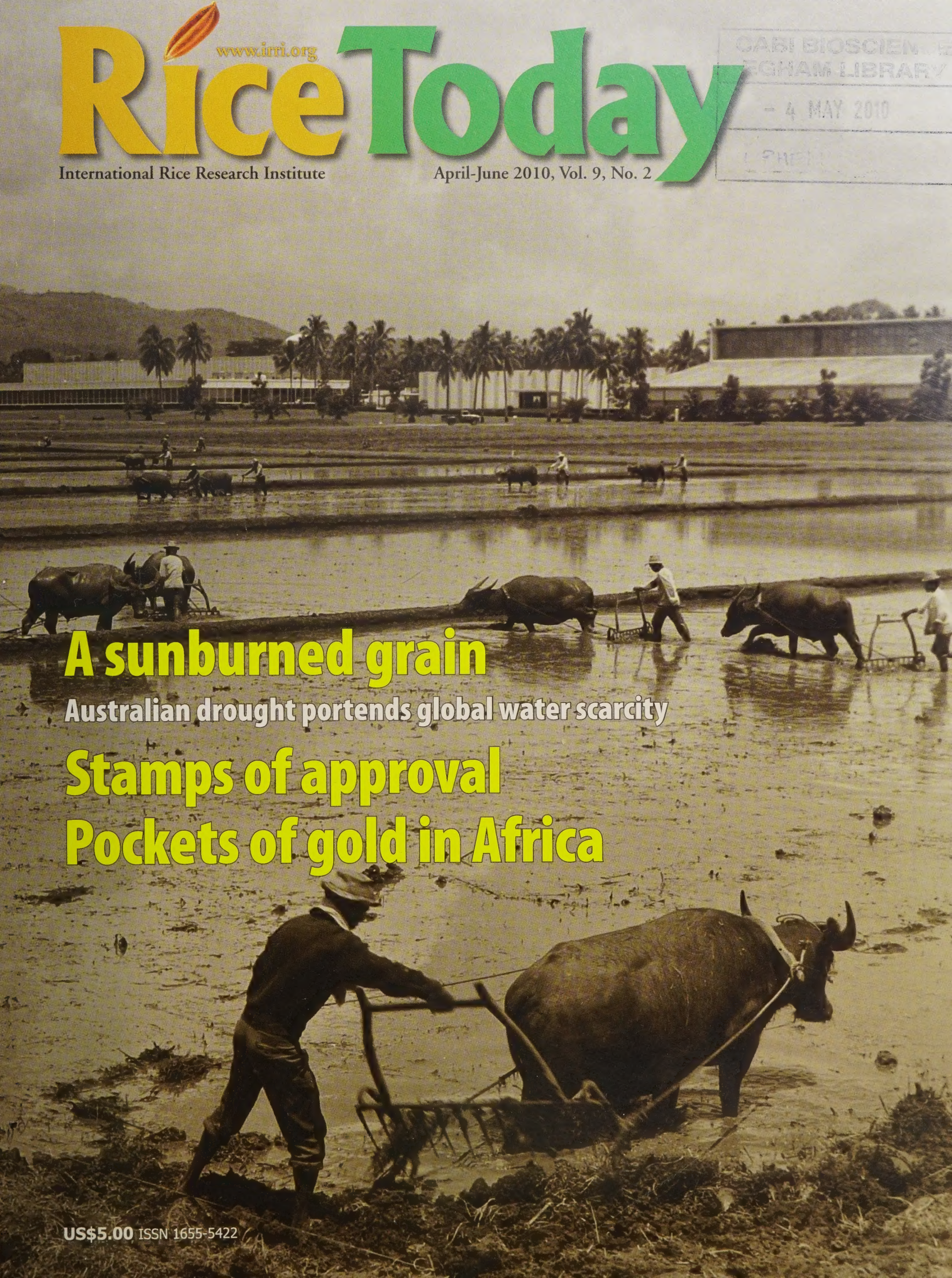


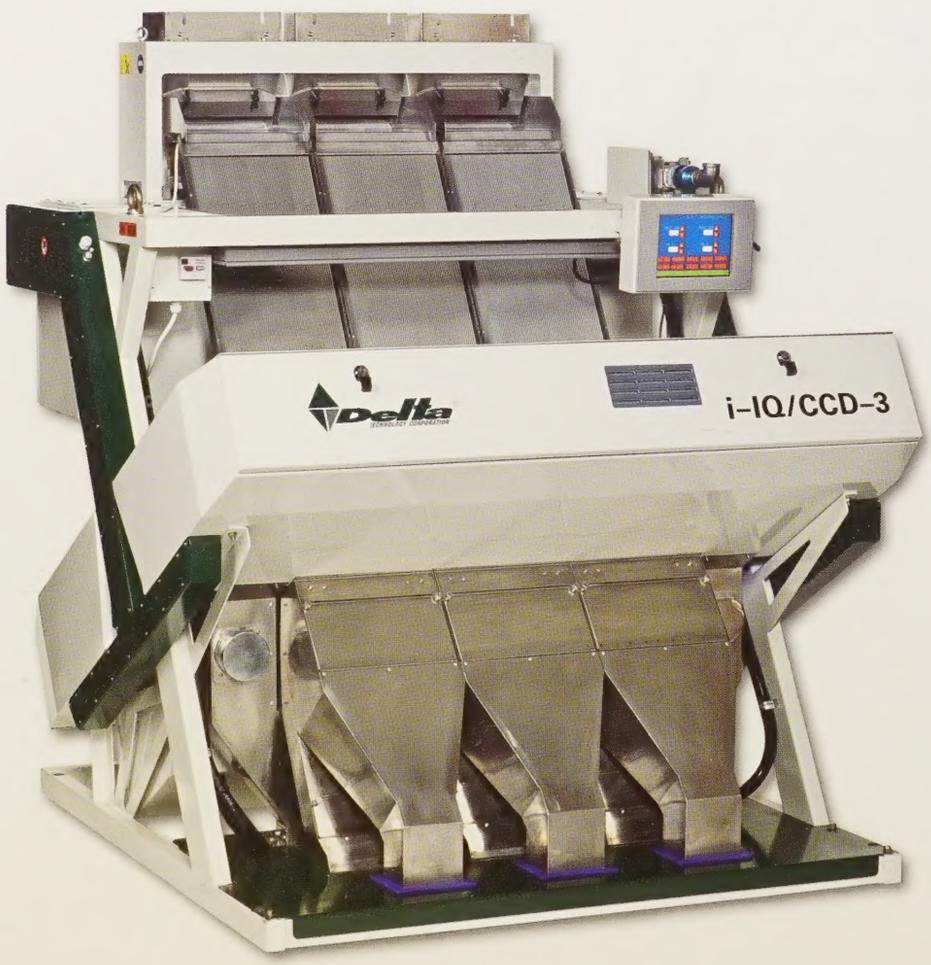
A sunburned grain
Australian drought portends global water scarcity

Stamps of approval

Pockets of gold in Africa

US$5.00 ISSN 1655-5422

NOTHING SORTS RICE BETTER THAN A DELTA!



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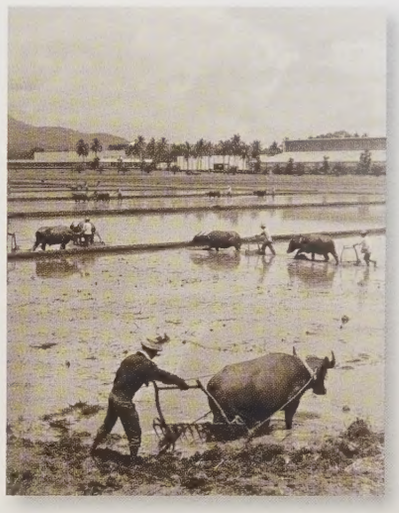

On the cover:
On the cover: In the early days, before IRRI's power tillers were designed and built, the Institute's experimental fields were prepared with carabao (water buffalo) power. In this photo, locally hired rice farmers and their animals till the plots for research to be conducted during the 1963 growing season. See pages 40-41 for the latest on IRRI's 50th anniversary activities.

Rice Today is published by The Rice Trader Inc. (TRT) in association with the International Rice Research Institute (IRRI).

TRT, for 20 years, has brought subscribers crucial, up-to-the-minute information on rice trade through its weekly publication, *The Rice Trader.* Acknowledged as the only source of confidential information about the rice market, this weekly summary of market data analysis has helped both the leading commercial rice companies and regional government officials make informed decisions, which are critical in today's market.

IRRI is the world's leading international rice research and training center. Based in the Philippines and with offices in 13 other countries, IRRI is an autonomous, nonprofit institution focused on improving the well-being of present and future generations of rice farmers and consumers, particularly those with low incomes, while preserving natural resources. It is one of the 15 nonprofit international research centers supported, in part, by members of the Consultative Group on International Agricultural Research (CGIAR – www.cgiar.org) and a range of other funding agencies.

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The Rice Trader Inc.
2707 Notre Dame Blvd., Chico, CA 95928
Web: www.thericetrader.com

International Rice Research Institute
DAPO Box 7777, Metro Manila, Philippines
Web (IRRI): www.irri.org; www.irri.org/ricetoday
Web (Library): http://ricelib.irri.cgiar.org
Web (Rice Knowledge Bank): www.knowledgebank.irri.org

Rice Today editorial
telephone: (+63-2) 580-5600 or (+63-2) 844-3351 to 53, ext 2725; fax: (+63-2) 580-5699 or (+63-2) 845-0606; email: mia.aureus@thericetrader.com, l.reyes@cgiar.org

publisher **Jeremy Zwinger**
associate publisher **Duncan Macintosh**
managing editor **V. Subramanian**
editor **Mia Aureus**
associate editor **Lanie Reyes**
contributing writers **Gene Hettel, Sophie Clayton, Samarendu Mohanty, Leah Baroña-Cruz, Trina Leah Mendoza**
Africa editor **Savitri Mohapatra (AfricaRice)**
copy editor **Bill Hardy**
art director **Juan Lazaro IV**
designer and production supervisor **Grant Leceta**
photo editors **Chris Quintana, Isagani Serrano**
advertising manager **Logan Wilson**
circulation **Lourdes Columbres**
Web masters **Forrest Orndorff, Darell Sison**
printer **DHL Global Mail (Singapore) Pte. Ltd.**

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50 years and beyond

IRRI 50 1960-2010

"Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world."
Louis Pasteur (1822-95), French chemist and microbiologist, discoverer of penicillin

The Founding Stone at the entrance to the International Rice Research Institute (IRRI) reads:
"An educational and research center devoted principally to the study and improvement of rice, the world's major food crop. Established by the Ford Foundation and the Rockefeller Foundation in cooperation with the Government of the Republic of the Philippines. Organized April 14, 1960. Dedicated February 7, 1962."

April 14 marks 50 years since the day the IRRI Board of Trustees held its first meeting in Manila, Philippines, and officially approved the architect's design of what was to become the Institute's headquarters in the university town of Los Baños in the province of Laguna, 60 kilometers south of Manila. The first Board chair was Dr. J. George Harrar of the Rockefeller Foundation in the United States. He was joined on that momentous day in 1960 by Dr. Paul C. Ma, the dean of the College of Agriculture of Taiwan National University; Paulino J. Garcia, the chairman of the National Science Development Board of the Philippines; Vicente G. Sinco, the president of the University of the Philippines; Dr. Hitoshi Kihara, a leading Japanese geneticist; M.C. (Prince) Chakrabandhu, the director general of the Department of Agriculture in Thailand; Juan de G. Rodriguez, the Philippine secretary of agriculture and natural resources; F.F. Hill from the Ford Foundation in the U.S.; K.R. Damle, the secretary of agriculture in the government of India; and Dr. Robert F. Chandler of the U.S. and IRRI's first director general.

It was an extraordinary gathering not only because the participants had traveled from around the world to set an agenda that would have a fundamental impact on the future of Asia but also because it was supported by the philanthropy of just two families: the Rockefellers and the Fords. Working with friends and collaborators across Asia over the next five decades, IRRI has been honored to be part of an extraordinarily productive partnership that has played a key role in one of the great success stories in human development. Scientists from many different nations working side by side made extraordinary contributions to food security in Asia through the Green Revolution in agriculture, providing increasingly inexpensive rice in ever more abundant quantities. In the process, they helped lay the foundations for economic growth in Asia that lifted more people out of poverty than ever before in human history.

Despite the impressive achievements of the past half century, the role and impact of rice research remain as crucial as ever. Poverty and food security are still major issues for many developing nations and threats such as climate change make the work of IRRI and its partners all the more challenging. It is for this reason that the Institute recently launched a 50th anniversary fund-raising campaign (www.irrifund.org) to find the resources and build the infrastructure IRRI will need to grow and accelerate its work now and into the future.

On IRRI's 50th anniversary, we not only celebrate those giants of rice research who came before us and honor their hard work, humanity, and dedication. We also look ahead to the great food security challenges of the future and hope that a new generation of visionary philanthropists and committed supporters will once again step forward.

Robert S. Zeigler
Director General

HISTORIC MEETING of the Board of Trustees of IRRI, 14 April 1960. From left end of table: Chairman J.G. Harrar, Paul C. Ma (*hidden*), Paulino J. Garcia, Vicente G. Sinco, Hitoshi Kihara, R.F. Chandler, M.C. Chakrabandhu, Juan de G. Rodriguez, and F.F. Hill. Not shown is K.R. Damle.

Hidden Treasure*

The Chinese New Year has just been celebrated across most of Asia as I write this issue's *Hidden Treasure*. For many in the industry, this signals a well-deserved "rest"—which we are sure is well appreciated. Unfortunately, for those of us here on the other side of the ocean, it is a time of activity, as the year ahead is evaluated, as the pieces of the supply puzzle fall into place, and as plantings and future supply across the Western Hemisphere are assessed against demand in the Americas, to build a model for what is left—in terms of rice exports—to the rest of the world.

Volatility has increased over the years as the weather becomes more unpredictable. This is a serious concern, as most countries and businesses have grown so used to some very favorable factors that have resulted in strong production for the past several years. Agrochemicals and new technology (in farming and postharvest) also helped deliver the required output to meet the growing population's needs. Yet, the variability in the weather cannot be ignored as it affects the level of stocks held by countries around the world. Several countries are forced to make decisions with the immediate circumstances in mind rather than plan for longer-term needs. This lack in foresight is a critical part of the business today that must be watched for its impact on the "psychology" behind decisions in the future.

Notably, Vietnam's massive winter-spring crop this year has depressed the region's market. We can't help but feel that at least part of this current weakness can be attributed to the fact that world rice markets have evolved since the "crisis" year of 2008—to take on this same near-term focused decision-making process that has ignored some very obvious long-term concerns that plague production.

The government of Thailand has similar issues—although the Thai rice industry is more sophisticated in terms of overall experience in exports and in the ambition to be a dependable supplier to the world—considering the 5 million metric tons or more of buffer supplies it currently has. The problem, however, is that this huge amount of stocks is becoming a real challenge to the government because, if it is sold at current market prices, Thailand will incur massive losses and deal with dire political ramifications. This will continue to be a major issue and a problem for most rice-producing (and exporting) nations, which grapple with food security, national issues, and the business impact of policy decisions.

Moreover, India continues to remain a critical variable in the year ahead. A lot of "PR" from the Indian government has been indicating that the country has high stocks of wheat and that it intends to use these to fill in the gap in consumption caused by the shortfall in rice production. Timing will be the key element here as the summer crop plantings and the monsoon ahead soon come into focus. While the possibility of the government reducing its stocks to minimize storage expenses is viable, these stocks remain the country's only insurance against the risk of another bad monsoon.

Oddly enough, a healthy amount of demand is available, but, with new crops coming in and augmenting supplies at several major rice origins, this factor has largely been overlooked by the market. The U.S. market forecasts increased production for 2010-11. But, as I travel right now in Arkansas, Missouri, and Texas, I am reminded that the weather once again needs to be monitored closely as the new planting season approaches. The question now is whether or not the expected demand will outweigh this concern. Adverse weather over the past 6 months has already caused a 10–15% reduction in supplies. Furthermore, Brazil continues to headline weather-related yield losses. Uruguay and Argentina have also been affected. Many feel that the decreased export volumes from these two countries will be combined to meet local demand (especially from Brazil), and stocks from the U.S. and Asia will likely be required to fill in the gaps. Markets are constantly in motion and, at present, I feel that the market has not yet fully integrated these substantial losses into the equation. Especially with a more short-term decision process, many of the longer-term prospects will likely be factored in only when they become a reality. Skepticism continues to abound as the massive Vietnamese (and Thai) crops arrive.

Contrary to what is happening in Asia, the medium-grain markets have seen U.S. exports already ahead by 25% compared to last year. This shows the level of demand that this market is receiving and also the shifts in demand that global markets continue to digest. Without an Australian availability, no fresh supplies are expected until October, as there is a fundamental shift in the way demand reveals itself to leave its mark on the price mechanism. Turkey's recent purchase of 200 thousand metric tons during the first quarter is just one example of how demand arrives and how swiftly markets react on the realization of the news.

The dollar situation and currency market moves are also crucial elements to watch: the Asian currencies, the euro, and the dollar that remains weighed down by the pressure of the U.S. debt and China's rise in the global village.

As we continue to watch the people who make "the market" and gain some understanding about the future, we would like to invite everyone to "The Rice Trader Americas Conference 2010" in Cartagena, Colombia, on 20-22 April 2010. An excellent panel of speakers will provide insights into rice industry developments and the road ahead. We have also arranged several social gatherings (including our great boat event). We hope to offer an excellent opportunity for all to network and build the intelligence needed for future business decisions.

Jeremy Zwinger

Jeremy Zwinger
Publisher

* The opinions expressed here are those of the author and do not necessarily reflect the views of the International Rice Research Institute.

Finding water to feed Singapore rice

Singaporeans consume around 275,000 tons of rice each year, which requires 688 billion liters of water to be produced—2.5 times Singapore's annual domestic water use.

Competition for water is getting fiercer and water supplies are dwindling, yet Singapore can contribute to securing its rice supply by joining the global community in helping farmers become water-wise. This is the key message from Dr. Bas Bouman of the International Rice Research Institute (IRRI), who presented "Preparing Rice for the Global Water Crisis" as part of the Environment and Climate Change Seminar Series of the Institute of Southeast Asian Studies (ISEAS), Singapore, on 10 March 2010.

"To produce one bowl of rice, it takes about 500 liters of water," said Dr. Bouman.

"For a city like Singapore, the question is whether the 688 billion liters of water needed to produce the country's rice will remain available."

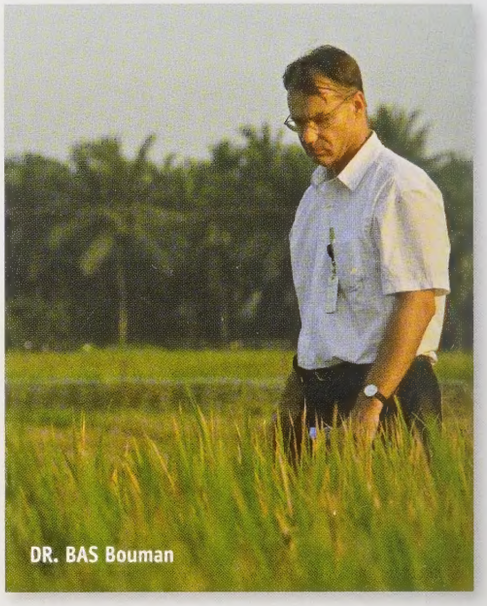
Worldwide, water for agriculture is becoming increasingly scarce as groundwater reserves drop, water quality declines because of pollution, irrigation systems malfunction, and competition from urban and industrial users increases.

Climate change will also reduce water availability in large parts of the world. And, by 2025, 15–20 million hectares of irrigated rice will suffer some degree of water scarcity.

"Farmers can reduce the amount of water they use to grow rice by 10–30% if they adopt water-saving technologies, such as alternate wetting and drying," said Dr. Bouman (see *Every drop counts* on pages 16-18 of *Rice Today* Vol. 8, No. 3).

"The hardest part is to deliver these technologies to farmers. The public and private sector need to mobilize to promote and implement the existing water-saving technologies through policies, partnerships, and extension and education efforts.

"At the same time, investments in research to develop new water-saving technologies need to be increased so that the future of rice production is safeguarded."


DR. BAS Bouman

Dr. Bouman's visit to Singapore was part of IRRI's 50th anniversary activities, which included the launch of the IRRI Fund Singapore and a campaign to raise US$300 million to support rice research, to help ensure sustainability of rice production, to reduce poverty and hunger, and to improve the welfare of rice farmers and consumers.

Source: www.irri.org

Vietnam: Facing a one-in-100-year drought

"If there is no water in the coming days," says 59-year-old farmer Vu Thi La, who just planted her spring rice seedlings, "it will all die."

Across Vietnam, high temperatures and parched rivers are setting off alarm bells as the nation grapples with what's shaping up to be its worst drought in more than 100 years. At 0.68 meter high, the Red River is at its lowest level since records started being kept in 1902.

Soaring temperatures in the central part of Vietnam have unleashed a plague of rice-eating insects, damaging thousands of hectares of paddies. "It's the beginning of everything," National Center for Hydro-Meteorological Forecasting Vice Director Nguyen Lan Chau says gloomily.

The region most affected is the Mekong River Delta in the south. Water levels in the nation's rice bowl have fallen to their lowest points in nearly 20 years, threatening the livelihoods of tens of millions of people who depend on the river basin for farming, fishing, and transportation.

The biggest problem, however, is not the water. It's the salt. During the dry season, when channels and tributaries run dry, seawater can creep more than 30 kilometers inland. Vietnam has installed a series of sluice gates to hold back high tides and control annual monsoon flooding. This has allowed farmers to switch between growing rice in the wet season and raising shrimp in the brackish waters in the dry period. In turn, this has resulted in a more effective land use and higher crop yields, and a doubling of farmers' incomes in the Delta since 1999.

Those high-yield days may be over. As the drought intensifies, in some places seawater has crept nearly 60 kilometers inland, says Dam Hoa Binh, deputy director of the Irrigation Department at the Ministry of Agriculture and Rural Development in Hanoi. Most of the winter-spring crop has already been harvested, but saltwater is reaching where it has never gone before, putting the summer-fall crop in jeopardy, says Binh. "We are trying to strengthen our irrigation systems to prevent further salinization," he adds, but the extreme conditions are making it "one of the most difficult situations in 100 years."

Source: www.time.com

Drought threatens Philippine rice terraces

The famous rice terraces of Banaue in Ifugao Province of the Philippines have been placed under a state of calamity due to the continued dry spell caused by El Niño phenomenon.

"The terraces have practically dried up to the extent that even a slight rain could cause landslides," said Banaue Mayor Lino Madchiw.

The dry spell has affected thousands of hectares of agricultural crops and livestock nationwide, and the drought now threatens Banaue's world famous rice terraces, leaving the paddies parched

and highly vulnerable to erosion.

Because of the drought, large earthworms have penetrated the paddies and endangered the terraces, which are a World Heritage Site and one of the country's top tourist attractions.

The perceived lack of interest among young Ifugao natives in taking care of the centuries-old terraces has aggravated the degradation of the site, sometimes referred to as the "Eighth Wonder of the World."

"At least 25% of the terraced rice farms have already been affected by the dry spell. [We fear] that our terraces will all be affected if the situation will continue for 4 more months," Madchiw said.

The dry spell has also put in peril the Tinawon red rice, Ifugao's special rice variety, which is sought after by both local and foreign tourists. Besides its high economic value, the Tinawon rice is also part of the Ifugao culture. It sells for 60–120 pesos (US$1.30 to $2.60) a kilo, making it a high-value crop.

Source: www.philstar.com

Malaysian rice farmers risk losses

The prolonged heat wave in the state of Kota Baru is threatening to ruin about 6,000 hectares of paddy because water for irrigation is drying up.

Kemubu Agriculture Development Authority (Kada) General Manager Ibrahim Mat said that the affected paddy fields were mostly in Pasir Mas and Tumpat.

He said that the fields could not be adequately irrigated because water could not be drawn from the Kelantan River—the main source of water for irrigation in Kada areas.

"Since the water level of the river is very low now, the water cannot be pumped into the irrigation canals," he said, adding that this had disrupted the irrigation schedule.

Ibrahim said that Kada would construct an embankment across the river at Kampung Kubang Pak Amin in Pasir Mas to raise the water level.

"We will use about 100,000 bags of sand to put up a wall across the width of the river so that our pump house can draw enough water when the level rises."

According to Wan Mohd Rudin Wan Abdul Ghani, Kampung Kubang Pak Amin village head, about 500 farmers and 1,776 hectares of paddy fields were affected by the dry season.

"The paddy plants, which are about 80 days old, are wilting. The plants need sufficient water to produce healthy rice stalks. If there is still no water over the next week or so, the chances are that their paddy plants might be damaged.

"With insufficient irrigation, the harvest for the farmers could be very low this season," he said, adding that they risked losses estimated at more than 10 million Malaysian ringgits (about US$3 million).

Source: www.nst.com.my

Philippines: More rice imports predicted

The Department of Agriculture disclosed that the country's rice production loss caused by the dry weather may be more than the estimated 800,000 tons, raising concerns that the shortfall may deepen.

"Even with our assistance like cloud seeding, crops just dried out in some towns," Agriculture Undersecretary Joel Rudinas said.

Increased losses may cause the government to boost imports beyond the record 2.45 million tons planned for 2010 after rains last year wiped out 1.38 million tons of the September-December harvest.

Source: www.businessweek.com

Africa Rice Congress endorses the Global Rice Science Partnership

About 500 participants from 54 countries attending the Africa Rice Congress 2010 in Bamako, Mali, 22-26 March, called for greater investments in Africa's rice sector, highlighted the need for a Marshall Plan for building capacity across the rice value chain, approved a task force model to tackle major rice challenges in Africa, and endorsed the Global Rice Science Partnership (GRiSP) initiative of the Africa Rice Center (AfricaRice), International Rice Research Institute, and International Center for Tropical Agriculture.

With its theme "Innovation and partnerships to realize Africa's rice potential," the Congress provided opportunities for the many stakeholders of Africa's rice sector and their partners to discuss strategies to significantly increase rice production in Africa, develop competitive and equitable rice value chains, reduce imports, and enhance regional trade.

Rice farmers, seed producers, rice processors, input dealers, manufacturers of agricultural machinery, and representatives from agricultural ministries, national rice research and extension systems, international and advanced research institutes, nongovernment organizations, the donor community, and other development partners actively participated in the event, which was organized by AfricaRice under the aegis of the Malian government in collaboration with the Malian national research institute, the Institut d'économie rurale (IER).

IRRI DIRECTOR General Robert Zeigler (*left*) participates in the Africa Rice Congress 2010, Bamako, Mali, 22-26 March.

Source: Africa Rice Center

Recognized

Fazle Hasan Abed, former IRRI Board of Trustees member (2001-06), was conferred knighthood by HRH Charles, the Prince of Wales, on behalf of Her Majesty Queen Elizabeth II, in February. Hailing from Bangladesh, Sir Fazle is the founder (in 1973) and chairperson of BRAC (first called the Bangladesh Rehabilitation Assistance Committee and later the Bangladesh Rural Advancement Committee), a fast-growing development organization.

Florencia Palis, IRRI scientist and agricultural anthropologist, won the Best Poster Award during the International Meeting on Health and Environment: Challenges for the Future held at the National Institute of Health in Rome, Italy, in December 2009. Her poster showcased her research on the effects of pesticide exposure on the health of Filipino farmers, done in collaboration with Dr. Satish Kedia, a medical anthropologist from the University of Memphis, USA.

K.L. Heong, IRRI senior scientist and integrated pest management specialist, was elected as a fellow of the World Academy of Art and Science, in recognition of his accomplishments in the natural and social sciences.

IRRI wins CGIAR science awards

The International Rice Research Institute (IRRI) won two of seven awards conferred by the Consultative Group on International Agricultural Research (CGIAR) at the Global Conference on Agricultural Research for Development, in Montpellier, France, 29 March 2010.

Winning the Award for Outstanding Scientific Article is "Soil Carbon and Nitrogen Changes in Long-Term Continuous Lowland Rice Cropping," IRRI's study, which was published in 2008 in the *Soil Science Society of America Journal* [72(3):798-807]. Based on analysis of soil samples collected over 15 years from four experiments begun during the 1960s, **Roland Buresh**, IRRI senior soil scientist, and three colleagues (**Mirasol Pampolino** and **Eufrocino Laureles** of IRRI and Hermenegildo Gines of the Philippine Rice Research Institute) determined that continuous rice monoculture on submerged soils consistently maintained or actually increased soil organic matter.

And, the Award for Outstanding Scientific Support Team goes to IRRI's Irrigated Rice Breeding Team, which is under the leadership of **Parminder Virk**, senior plant breeder, and is composed of **Antonio Evangelista**, **Mario Garcia**, **Alvaro Pamplona**, **Danny Balagtas**, **Nestor Ramos**, **Arsenio Morales**, **Benito Romena**, **Macario Perez**, **Vitaliano Lopena**, **Virgilio Angeles**, **Elma Nicolas**, and **Nelie Delos Reyes**. The team is responsible for maintaining a continuous supply of new rice varieties for irrigated production.

IRRI'S IRRIGATED rice breeding team.

New BOT members

Three new members of the IRRI Board of Trustees assumed their posts in January 2010: **P. Stephen Baenziger**, **Zhai Huqu**, and **Joyce Kikafunda.** They replaced **Ronald Phillips**, **Ruth Oniang'o**, and **Baowen Zhang**, who completed their terms last year.

Dr. Baenziger is the Eugene W. Price Distinguished Professor in the Department of Agronomy and Horticulture at the University of Nebraska, where he has worked for more than 20 years. He earned his BS degree in biochemical sciences from Harvard University and his MS and PhD in plant breeding and genetics from Purdue University. He worked for the United States Department of Agriculture for 8 years, particularly focusing on wheat and barley germplasm enhancement. Then he spent 3 years with Monsanto Corporation and worked on wheat plant growth regulators and biotechnology.

Prof. Zhai is president of the Chinese Academy of Agricultural Sciences and former president of Nanjing Agricultural University. He greatly contributed to quantitative genetics and crop breeding research, research on hybrid rice, capacity building for crop breeding programs, and science innovation. He holds a PhD in plant genetics from the University of Birmingham in the U.K.

Prof. Kikafunda is associate professor in the Department of Food Science and Technology, Makerere University, in Kampala, Uganda. She earned her MS degree in food science and technology from the University of Saskatchewan, Saskatoon, Canada; and her PhD in food science and nutrition from the University of Reading in the U.K. Her research areas include child nutrition, food fortification, and food consumption patterns.

Five new principal scientists

IRRI appointed five new principal scientists in January: **Roland Buresh**, **Jagdish Ladha**, **Hei Leung**, **David Mackill**, and **To Phuc Tuong**. At IRRI, principal scientists are regarded as foremost experts in their fields—recognized for their contributions that have made great impacts on research.

New staff

IRRI welcomed new internationally recruited staff **Corinta Guerta**, **Chengzhi Liang**, **Andrew Nelson**, **Valerien Pede**, **Alfred Schmidley**, and **Chengzhi Liang**; new visiting research fellows **Jong-Hee Lee**, **Sang-Bok Lee**, **Alagarswamy Senthil**, and **Syed Jabbar**; new postdoctoral fellows **Andrew Cal**, **Murali Krishna Gumma**, **Impa Somayanda**, **Srinivasachary**, **Vivek Thakur**, **Changrong Ye**, **Wei Zhou**, **Huaiyu Wang**, and **Govinda Rizal**; collaborative research assistant **Bjoern Ole Sander**; collaborative research fellow **Isaac Kofi Bimpong**; visitor and collaborator **Mark Fabreag**; intern **Katie Nelson**; and consultants **Julian Hibberd**, **David Paige**, and **Terry Jacobsen**.

TRAINING COURSES AT IRRI

Introduction to R: Data Manipulation and Statistical Analysis

IRRI Training Center, Los Baños, Philippines
26-30 April 2010

This course introduces the participants to the basics of the R Statistical Computing Environment under Windows. The R Statistics Computing Environment is a free, open-source software. It consists of a set of core modules that make up the R distribution, as well as more than 500 contributed packages from various sources. R is designed in a computer language that requires participants to work mainly with a command-line interface, using the R language.

The course will provide lectures and hands-on practical exercises. Participants must be computer proficient and must be familiar with basic statistical methods, including hypothesis testing, analysis of variance and regression, and correlation analysis; or, they should have at least attended the Basic Experimental Designs and Data Analysis course.

Introduction to Gene Mapping: Linkage and Association Mapping

IRRI Training Center, Los Baños, Philippines
17-21 May 2010

This course introduces the participants to the basics of gene mapping using software packages such as R/qtl, R/GenABEL, R/genetics, R/LDheatmap, and R/popgen. The training course will provide lectures and hands-on practical exercises. Participants must be computer proficient and have basic knowledge in genetics. They must also be familiar with R data manipulation or should have at least attended the first two days of the Introduction to R: Data Manipulation and Statistical Analysis course.

Rice: Research to Production

IRRI Training Center, Los Baños, Philippines
17 May-4 June 2010

This course aims to create a new generation of plant scientists that are well networked in the international community and understand the importance of innovative plant science in tackling global problems. Topics include an understanding of the basics of rice production in Asia; familiarity with the germplasm collection at IRRI and current issues related to germplasm exchange and intellectual property; an appreciation of the research issues of IRRI and its developing partners; hands-on skills relating to rice breeding, molecular genetics, and genomics; an understanding of how to structure effective international collaboration; and a plan and personal contacts to work effectively as part of the international research community in the future.

ILAC-IRRI Group Facilitation Skills for Participatory Decision-Making

IRRI Training Center, Los Baños, Philippines
8-11 June 2010

This workshop aims to strengthen students' capacity to facilitate meetings, teams, and group decision-making processes. Its hands-on practical approach will enable the participants to immediately apply what they have learned to their day-to-day work. Topics include what facilitation is and why it is important; how to facilitate meetings and teams; how to manage conflicts and disagreements; and how to build consensus for decision-making. Professionals involved in participatory projects, networks, or meetings are encouraged to attend. Participants must have an excellent command of the English language.

For more details, contact Dr. Noel Magor, head, IRRI Training Center (IRRITraining@cgiar.org) or see **www.training.irri.org.**

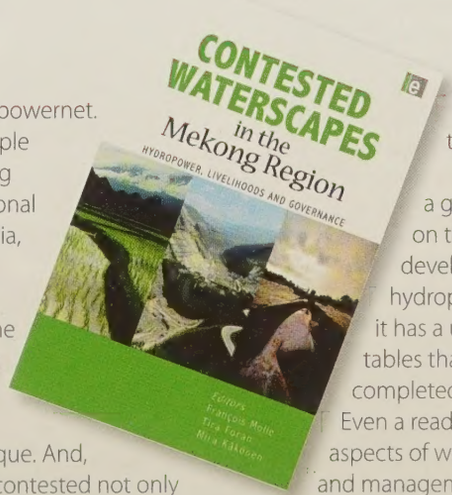
NEW BOOK http://books.irri.org

Contested Waterscapes in the Mekong Region: Hydropower, Livelihoods, and Governance

Reviewed by: Randy Barker,
Edited by: François Molle, Tira Foran, and Mira Käkönen
Published by: London and Sterling, Virginia: Earthscan, 2009.

This book, *Contested Waterscapes in the Mekong Region*, makes very clear that demand is growing for water for nonagricultural uses—hydropower, urban consumption, and industry. Agriculture, for which approximately 80% of water is diverted, will thus receive less and less water in the future. Some observers are concerned about the prospects for global warming and the melting of the Himalayan glaciers. But, even without this problem, we will have to move from development to management of water resources. Most Asian governments have not realized the need for this change, let alone considered how it is to be accomplished.

It is against this backdrop that this book has been written. It is a product of M-Power or The Mekong Program on Water Environment and Resilience, www.mpowernet.org—a network of "people committed to improving local, national, and regional governance in Cambodia, China, Laos, Myanmar, Thailand, and Vietnam." The fact that not just one or two countries but six use the water of the Mekong is what makes the Mekong region unique. And, the region's waters are contested not only among countries but also within countries—among agencies and organizations with particular interests in one of the multiple uses of water such as for irrigation, hydropower, urban consumption, and the environment.



These agencies do not typically talk to one another. This book contains a great deal of information on the politics of dam development for both hydropower and irrigation. And, it has a useful set of maps and tables that locates and defines both completed and planned dam projects. Even a reader well versed in various aspects of water resource development and management will find this book a valuable reference.

Dr. Barker's full review can be found online at http://snipurl.com/uqqcf and more information about the book is at http://snipurl.com/v5qxp.

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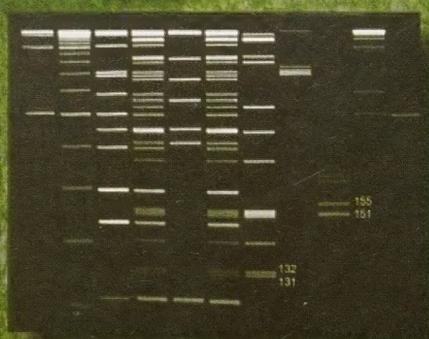

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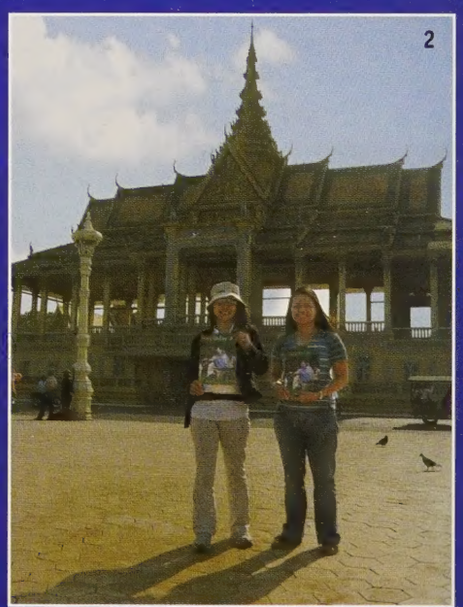

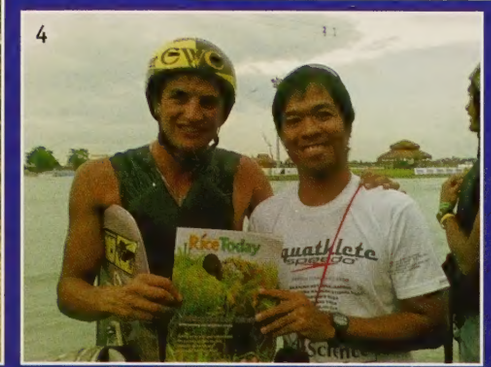

1. LADY BY the lake. Duong Phuong Thao of the Ministry of Industry and Trade (Vietnam) enjoys the serene atmosphere of Hanoi Lake while reading *Rice Today*.
2. BLAST FROM the past. *Rice Today* associate editor Lanie Reyes and Irrigated Rice Research Consortium communication specialist Trina Mendoza bring the magazine's maiden issue back to Cambodia. They happily pose at the Chan Chaya Pavillion, Phnom Penh Royal Palace. The Kingdom provided *Rice Today* with its very first cover story in 2002.
3. ROYAL COVER. Thai farmer Vichian Insawang from Tabol Banglarng, Suphan Buri Province, treasures this *Rice Today* issue, which has HRH Princess Maha Chakri Sirindhorn of Thailand on the cover.
4. WILD, WILD wet. *Rice Today* makes a splash at the Cobra Ironman 70.3 water sports competition held in 2009 in Camarines Sur, Philippines. Paul Hilario (*right*) of Riceworld Museum introduces the magazine to the event's 2008 world champion, Terenzo Bozzone of New Zealand.

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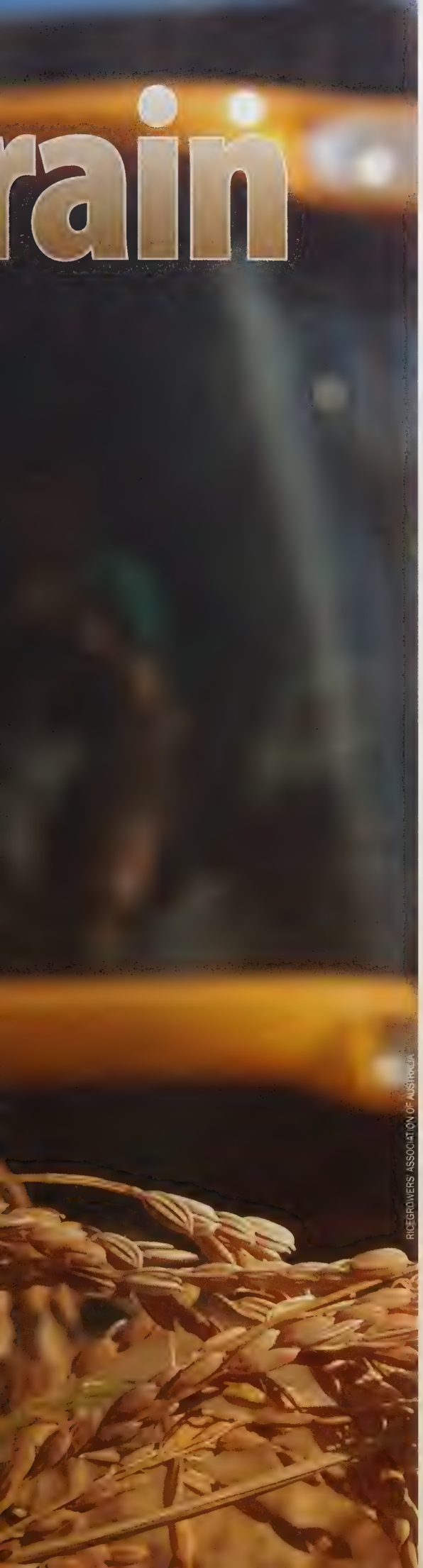
A sunburned g

by **Adam Barclay**

Water-intensive rice farming is a contentious issue in a bone-dry country. But, despite battling negative public opinion and an 8-year drought—which isn't over yet—Australian rice growers are optimistic about the future.

AS LONG as there's enough water to grow rice, Australia's highly efficient rice industry achieves some of the highest yields in the world.



Reporting the impact of an 8-year drought on rice production is a strange caper, I thought, as the wheels of a four-wheel motorbike covered me head to toe with mud. I was sitting behind Rob Houghton, a farmer from just outside Leeton in the Australian state of New South Wales, who was driving me through the pouring rain to his ... soybean field. When I met Mr. Houghton, I expected him to take me to his rice field. The problem is, he's not growing any this year. Despite the morning's deluge, Mr. Houghton wasn't allocated enough water this season to ensure a good rice crop. The alternative was soybeans, which, although not as profitable (see Table), don't need as much water.

"There have been only 2 years since my father started growing rice here in 1942 that we haven't grown rice, and they've been in the last 5 years—this year and 2 years ago," says Mr. Houghton.

Australian rice production from 1999 to 2002 averaged more than 1.3 million tons per year. In 7 years, from 2003 to 2009, the average was less than 360,000 tons. The 2008 harvest saw the lowest production since the industry began in Australia, at a mere 19,000 tons (see figure below). The drought average is actually flattered by a million-ton crop in 2006, partly the result of an advance of growers' future years' water. The 2010 crop is expected to bring in around 185,000 tons.

Mr. Houghton farms 520 hectares in the Riverina region of southwest New South Wales, which includes the Murray Valley, Murrumbidgee, and Coleambally Irrigation Areas (see map on page 16). Overall, the region is home to around 1,500 rice-farming families.

Before the drought began in 2002, Mr. Houghton grew a rice crop of 100–150 hectares each Australian summer (planting in October-November and harvesting in March-April). His farm yielded about 10 tons per hectare. Since the rains failed, that area for rice has fallen to an average of around 30 hectares per year, excluding the seasons in which he grew no rice at all.

"The summer crop is where we really make our money," says Mr. Houghton. "In drought times, though, we've really ramped up our winter crop program because your water goes so much further."

The long-term lack of rain has not only reduced the amount of water available to farmers, but it has also increased water requirements when rice *is* grown. In better times, Mr. Houghton needed 13 million liters (megaliters) of water per hectare per season to grow rice. In the 2008-09 season, with water tables sinking lower and lower after almost a decade of drought, the figure was 22 megaliters.

"We just need a good wet winter to sort that out," says Mr. Houghton. "It's only a short-term impact, but you can't grow rice economically using 22 megaliters per hectare and, environmentally, it's not a sound move either."

Water use, productivity, and profitability for 2006 summer crops in the Murrumbidgee Irrigation Area

Crop	Megaliters	AU$/ha	AU$/ML
Rice	13.5	1,675	124
Cotton	10	1,136	114
Lucerne	10	2,197	220
Maize	8.5	839	99
Soybean	8	483	60

Data source: Compiled by Laurie Lewin from summer crop gross margins at www.dpi.nsw.gov.au (now www.industry.nsw.gov.au)

Australian rice production (1999-2009).
Data source: SunRice

Water sharing

Aside from limiting crop choices, he says that the dry spell has forced the region's rice growers to make fundamental changes to the way they farm. Growers are becoming much cannier in the way

ADAM BARCLAY /4

A SIGN of things to come in the Australian Rice Industry? Leeton's historic water towers, which are almost 100 years old, are reminders of how water availability and the town's fortunes are inextricably linked.

they shape their fields to make the best possible use of the water they have. By using clever contouring, coupled with well-planned drainage and recirculation systems, many Riverina farmers can grow a winter crop by simply using the residual moisture of the preceding rice crop—no or minimal supplementary irrigation is needed.

Such efficient use of water (Australian rice growers are regarded widely as the most water-efficient in the world) is one of the arguments the rice industry here uses to counter claims by many—especially people living in the parched southern Australian cities—that water-thirsty rice simply shouldn't be grown in temperate Australia. If you look at rice as part of an annual cropping cycle, the water used per ton of food produced presents a far more compelling equation than that of rice viewed in isolation.

Nevertheless, according to Arlene Buchan, healthy rivers campaigner for the Australian Conservation Foundation (ACF), current levels of water allocation present a major threat to rivers and wetlands in the Murray-Darling Basin. As the country's food bowl and most important river system, the basin supplies water to the majority of Australia's population in the cities, towns, and farms across the more densely populated southeast quarter of the continent.

"Overextraction of water for irrigation is the biggest driver of environmental degradation," says Dr. Buchan, who also points out that the ACF itself is not anti-rice. "The way you fix things is not by mandating what crops you can grow in what areas. You fix it by getting the sharing of water right. If you say to a rice or cotton grower, 'no more rice, no more cotton,' they're just going to grow something else. They'll use the same amount of water, which doesn't benefit the environment."

Rice: last in the hierarchy

Water in the Murray-Darling Basin is allocated in a hierarchy, beginning with "critical needs" (for domestic, industrial, and stock use), followed by so-called high-security entitlements (for permanent plantings such as fruit trees and grapevines), and finishing with general security entitlements (for annual crops such as rice and wheat). In times of water shortage, allocations for annual crops—which can be effectively switched on and off each year—are slashed first. In this way, water availability dictates what farmers can and can't grow. The implication is that, if allocations are appropriate, the question of banning specific crops—such as rice or cotton—is a moot one.

Coleambally rice grower Lynne Stuckings, who farms 405 hectares with her husband, John, grew around 145 hectares of rice annually before 2003. "Since the drought, we've had a couple of years without rice," she laments. "Last year, we grew 24 hectares; this year, we've got 48 hectares."

Ms. Stuckings contends that many growers feel that there is sufficient water allocated to the environment already, though she concedes that it's a farmer's point of view. Regardless, she says, "We look after our environment—we want to pass our farm on to future generations. We're not actually wasting water; we're growing food with it."

Wayne Meyer, professor of natural resources science at the University of Adelaide, spent almost 2 decades working on irrigation issues in the Riverina region with the Commonwealth Scientific Industrial and Research Organisation (CSIRO) and Charles Sturt University. He agrees with the ACF that there needs to be a rebalancing of water allocations.

"The evidence is absolutely stark that the water entitlements have been overallocated," he says.

When the allocation system was set up, there was less environmental awareness, in general, and the government awarded licenses in numbers "which far exceeded in dry times any capacity for the system to deliver," says Prof. Meyer. "The consequence is that

LEETON FARMER Rob Houghton manages the irrigation of the soybean field that would have been full of rice if not for the Riverina region's 8-year (and counting) drought.

COLEAMBALLY RICE farmer Lynne Stockings with granddaughter Avaril.

the river is drying from the mouth up. Having it dry up before it gets to the end is a sure way to stuff up your natural resources."

However, Prof. Meyer also agrees that blaming rice farmers is not the solution. For a start, he counters the claim that rice and cotton farmers are the heaviest water users. "That's never been true," he says. "The major amount of water used in the Murray-Darling system is for pasture. Both in volume and area, it's by far the biggest amount, and most of that is dairy pasture."

Postdrought future

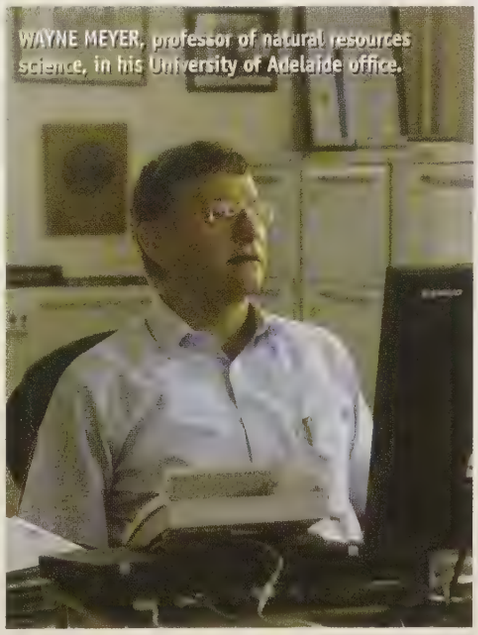
In the 1980s and 1990s, Prof. Meyer said that one of the problems stemming from water-intensive agriculture was that water tables were rising and bringing salinity with them. He and his colleagues investigated ways to reduce drainage to a point sufficient to maintain salt balance but low enough to keep groundwater levels down. He argues that if farmers were bound by drainage limits (along with appropriate water allocations), then, "whether you grow rice, cotton, beans, or whatever, if you can operate within those constraints, then go for it. The limit shouldn't be on determining what crop you grow but on the operating conditions, which are set on the basis of looking after the public asset."

Sure enough, the rice industry is bracing for a postdrought future of below historical allocations. In mid-2010, the Murray-Darling Basin Authority (the federal government agency responsible for planning the basin's water resource management) is scheduled to release its much-awaited Basin Plan, which is set to include "sustainable diversion limits" that will almost certainly mean less water for farmers in the Riverina.

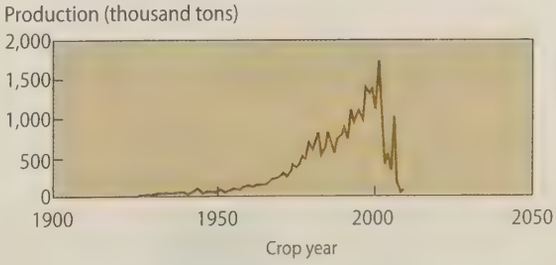
"But there isn't anything in that plan that will devastate us like the drought has," says Ruth Wade, executive director of the Ricegrowers' Association of Australia, a voluntary organization made up of current and retired rice growers.

Before the drought, the rice industry planned its operations around annual production of about 1.2 million tons. In anticipation of reallocation, this has been revised down to about 800,000 tons (see figure below).

"It would be irresponsible for us to pretend that the future will look the same as the past," says Ms. Wade. "We'll have less water, so it was responsible to consider where the tipping points for the industry are to maintain our core infrastructure, to maintain markets, etc.



WAYNE MEYER, professor of natural resources science, in his University of Adelaide office.



NSW rice production (1925-2009).
Data source: Compiled by Laurie Lewin from data supplied by SunRice.

RUTH WADE, executive director of the Ricegrowers' Association of Australia, in her Leeton office.

RICEGROWERS' ASSOCIATION OF AUSTRALIA INC

RICEGROWERS' ASSOCIATION OF AUSTRA...

It'll be a different industry, but it'll also be strong and vibrant again."

As is always the case when farming regions are hit by drought, the surrounding communities suffer. Businesses that depend on farmers have been hit particularly hard.

"You've only got to walk up the street here," says Mr. Houghton, gesturing to the main street of Leeton, "to see the vacant shops where people haven't been able to continue."

Ms. Wade emphasizes the interdependency of communities across the rice-growing region. "Take the rice industry out of towns like Leeton, Coleambally, and Deniliquin, and they bleed to death," she says. "Deniliquin has had it really tough. They lost their mill, they lost all of the transport systems that go with it. Transport companies, all of the people involved in the storage and supply systems—they all suffer."

Water trading

To maintain a livable income through this lean period, some farmers have become water traders, selling their allocations temporarily to other growers. Others have opted to sell their allocation permanently to the federal government, which, as part of its *Water for the future* program, has set aside AU$3.1 billion (US$2.8 billion) over 10 years to buy from irrigators in the Murray-Darling Basin water that will remain in the natural environment.

Although at this stage there are

no mandatory water buybacks, many farmers see little choice.

"The government says they only buy from willing sellers, but they're not actually willing," says Ms. Stuckings. "They're farmers under duress because we're in drought. And banks are starting to put pressure on people, too, so people have no other options."

Coleambally offers, perhaps, the most striking example of a strategy to deal with drought. With the government looking to purchase water allocations quickly, there were worries that the area would disintegrate into a messy patchwork of irrigated and dryland farms with an unworkable water supply system in between. Envisaging dire consequences for the community, Robert Black, then chairman of the Coleambally Irrigation Area, in August 2008, offered the whole town up for sale to the government for AU$3.5 billion ($3.2 billion). All of it. Every business, every shop, every home, along with every

KANGAROOS BOUND through a winter wheat crop, grown on the residual moisture of the preceding rice crop—with little or no supplementary irrigation.

RICEGROWERS' ASSOCIATION OF AUSTRALIA

drop of the area's 600,000 megaliters of water entitlements. Although nobody took the sale seriously, it made the point that, if the government is to buy water allocations, it needs to do so in a considered, strategic way.

Mr. Houghton says that a portion of the farmers who have sold their allocations have stayed on their property because they want to remain farmers, but have changed their operations to grazing or dryland cropping. Others, especially older farmers, have used the sale as an opportunity to exit agriculture. But, overall, "There hasn't been a 'sell and move out; there's no future in this' kind of mentality."

Sunny outlook

Several factors combine to make rice in Australia successful: the climate (when there's enough water), which provides a huge amount of sunlight; expert producers who average around 10 tons per hectare (with some growers achieving more than 14 tons); and the tight integration of the production, commercial, and research arms of the industry.

The commercial arm is represented by Ricegrowers Limited (trading under the name SunRice), a company owned

SUNRICE

SunRice medium grain is packed at the company's Leeton packaging plant. Because of the drought-induced drop in rice production, SunRice was forced to place the other two of its Riverina processing operations in care-and-maintenance mode.

SunRice Chief Executive Officer Gary Helou (*left*) and Grower Services General Manager Mike Hedditch at SunRice headquarters in Leeton.

by the growers, former growers, and employees. Before the drought, Australia, through SunRice, exported to around 70 countries more than 80% of the medium-grain japonica rice in which it specializes (the last few years have seen almost no exports at all). Although the country is not a major producer or exporter on a world scale, it contributes 20–25% of world medium-grain trade.

No industry can lose most of its core commodity without being forced into major changes. In the last few years, SunRice—which currently employs more than 600 staff in Australia—has placed several processing plants in a care-and-maintenance mode and laid off more than 200 employees. You could be forgiven, then, for failing to guess that in the 2008-09 financial year, the company posted its biggest ever profit, generating around AU$900 million ($816 million) in revenue.

"It's a case study of how to manage through revolutionary change," says Ms. Wade. "They lost almost 100% of their raw product and grew their business dramatically."

Capitalizing on its strong brand and reputation for quality, SunRice—which has acquired milling and storage operations in several countries—has, over the past few years, ramped up its efforts to source, process, and brand rice overseas. SunRice has also stepped up the production and marketing of ready-to-eat rice meals and snacks.

The record profit prompted some anxiety among the drought-afflicted Australian growers who began to wonder if SunRice no longer needed them. According to Ms. Wade, they have nothing to fear: "The company has said, 'there isn't anybody in the world who can grow what you grow here; we need your product back again. Nobody can produce it as effectively or as efficiently as you can do it here.'"

Despite the financial success of the business, SunRice Chief Executive Officer Gary Helou insists that the company is eager for a return to higher production.

"The drought has been catastrophic for us," he says. "I'm not being melodramatic by saying that. You don't drop your production by 90% and not suffer. It's been a massive event, with many downsides to it from farmer, community, and industry points of view. The business, on the other hand, helped mitigate those downsides by remaining strong."

Mr. Helou says that the company will emerge from the drought a much stronger company. "Our expansion overseas was partly to secure sources but also partly growth—we want to grow beyond the production capacity of Australia. This drought helped us understand not only where the supply points are and how you can move things efficiently, but it also gave us a growth platform."

Mr. Helou believes that, once the drought breaks, the combination of a strong Australian crop with their expanded overseas network can boost SunRice's share of the world medium-grain market to 30–35%.

Rice legacy

Despite the industry's optimism, Mr. Houghton worries about the impact of the drought on the next generation of farmers. "I have a son who's 14," he says. "He hasn't seen the good times. All he's seen is drought; all he's heard about in agriculture is how to cope with drought."

He adds, with a quizzical tone, that his son still wants to be a farmer, "and I don't really understand why. But there are a lot of young guys who don't even consider farming as an option because it's just too hard."

Nevertheless, he sees rice as being a part of Riverina farming in the long term.

"It's such a marketable commodity," he says, "and the branding of the industry is so strong both domestically and internationally. We'll never get back to 'the good old days,' but we've made major improvements in our water efficiency and management, so we'll get a lot more out of the water into the future. There's no doubt that water will be leaving irrigated agriculture here, but, for people who want to make a career out of rice, I think there's a huge future."

Mr. Barclay is a freelance writer based in Australia.

The trouble

For Rachelle Ward, a cereal chemist at Yanco Agricultural Institute in the Australian state of New South Wales (NSW), competing with fellow staff for access to lab equipment is a thing of the past. Many scientists would envy her if it were not for the reason behind her "fortune." That reason is, in short, a lack of rain.

The town of Yanco sits in the northeast quarter of Australia's rice-growing region (see map on page 16), which has been suffering one of its worst droughts in recorded history. The institute, a state government entity supported by Industry and Investment NSW (formerly the NSW Department of Primary Industries), houses the Centre of Excellence for Sustainable Rice and Horticulture.

Traditionally, the Centre's funding

Australia's "rice family" works together to kee

with rain

Story and photos by **Adam Barclay**

ne industry from drying up and succumbing to drought

has been tied to rice production through the federal government's Rural Industries Research and Development Corporation (RIRDC) Rice Research and Development Program, which is partly funded by levies contributed by rice farmers. The levies in turn are matched dollar for dollar by the government. The more rice produced, the higher the levies. The only problem is, for the last 3 years—since the beginning of the drought—Australia hasn't produced much rice. From an average of well over 1 million tons a year, 2008 saw a paltry 9,000 tons harvested.

To quote from the RIRDC Web site (http://tinyurl.com/yayxnze): "With production expected to be less than 1% of normal production in 2008, levy income will be reduced to less than AU$236,000 [US$216,000] in 2008-09. As a result, our year commitments cannot be covered and key research staff will not be able to be retained by the Program."

As the rain has dried up, so has funding for rice research—precisely when it is needed most. Thus, the remaining Yanco researchers have the lab equipment all to themselves. Unfortunately, much of it isn't working.

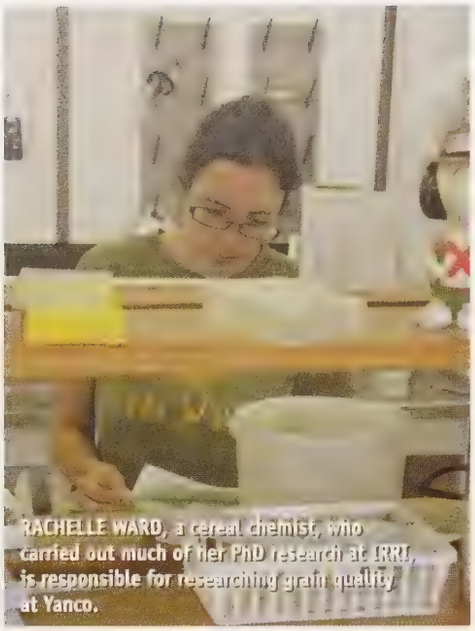
"Since we've had the downturn in funding, half of our equipment has been turned off," says Dr. Ward, who did much of her PhD training at the International Rice Research Institute (IRRI) under the supervision of Melissa Fitzgerald, head of IRRI's Grain Quality, Nutrition, and Postharvest Center and a former cereal chemist at Yanco. "It can cost AU$10,000 [$9,200] a year to run one machine. We don't have that. Nor do we have spare funds to pay a person to run that machine."

The budget cuts of the past few years have meant that the institute has had to streamline its priorities down to a core trio: breeding for water productivity, breeding for cold tolerance, and grain quality. Despite these challenges, the Yanco scientists remain staunchly optimistic.

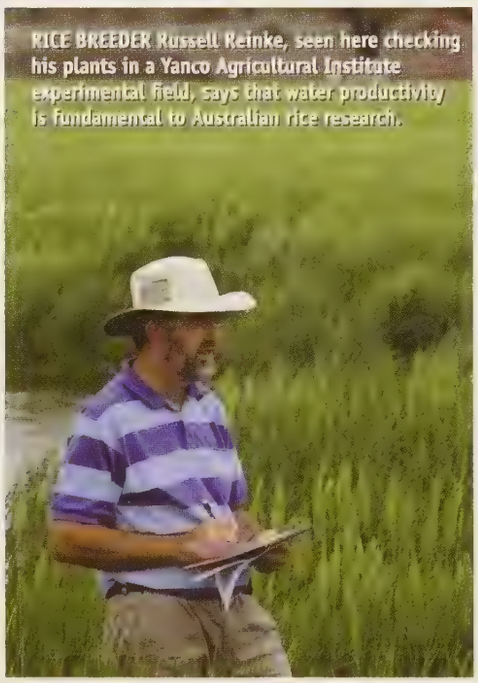
"I think we've become a lot more innovative since we've had our funding cut," says Dr. Ward, who also views the forced change as something that will strengthen the institute's research in the long run. "I keep thinking it's like a war. A lot of innovative science happens during times of war, and you never return to prewar conditions."

Water efficiency

Despite its relatively small size on a world scale, the Australian rice industry



RACHELLE WARD, a cereal chemist, who carried out much of her PhD research at IRRI, is responsible for researching grain quality at Yanco.



RICE BREEDER Russell Reinke, seen here checking his plants in a Yanco Agricultural Institute experimental field, says that water productivity is fundamental to Australian rice research.

PETER SNELL is the breeder tasked with developing cold-tolerant rice varieties that can withstand the cool night-time temperatures that hit Riverina even in summer.

has been indisputably successful since its beginnings in the early 20th century. A husband and wife who had moved to Australia from Japan, Isaburo (Jo) and Ichiko Takasuka, planted Yanco's first experimental crop in 1915, proving that rice could be grown in Australia. Subsequently, seed was imported from the similar soils and climate of California, where a rice industry had already been established. With the Californian varieties a success, rice gained a foothold in the Riverina, a region of New South Wales (see map on page 16), and a vibrant industry thus emerged.

When not ravaged by drought, the industry has carved a growing domestic and international niche for the medium-grain japonica rice in which it specializes, exporting approximately 80% of overall production to around 70 countries in recent nondrought years.

If the Australian rice industry's success can be boiled down to two fundamental bones, they would be the rice region's favorable climate (drought notwithstanding) and the unique integration of the farming, research, and commercial arms of the industry. These factors combined result in some of the highest yields in the world, with a regional average of around 10 tons per hectare and some growers achieving more than 14 tons.

Russell Reinke, who runs the rice breeding program at Yanco with fellow breeder Peter Snell, says that, given the magnitude of water issues in Australia, there is a constant drive to improve water efficiency. This has been achieved using several approaches, including breeding more water-efficient rice varieties, ensuring that rice isn't grown on leaky soils, and simply pushing the yield envelope to grow more rice per hectare without using more water.

"The other thing we've done is to reduce growth duration while not sacrificing yield," says Dr. Reinke. "When you can sow a variety 2 or 3 weeks later in the season, you've avoided a certain amount of evaporation from the water surface."

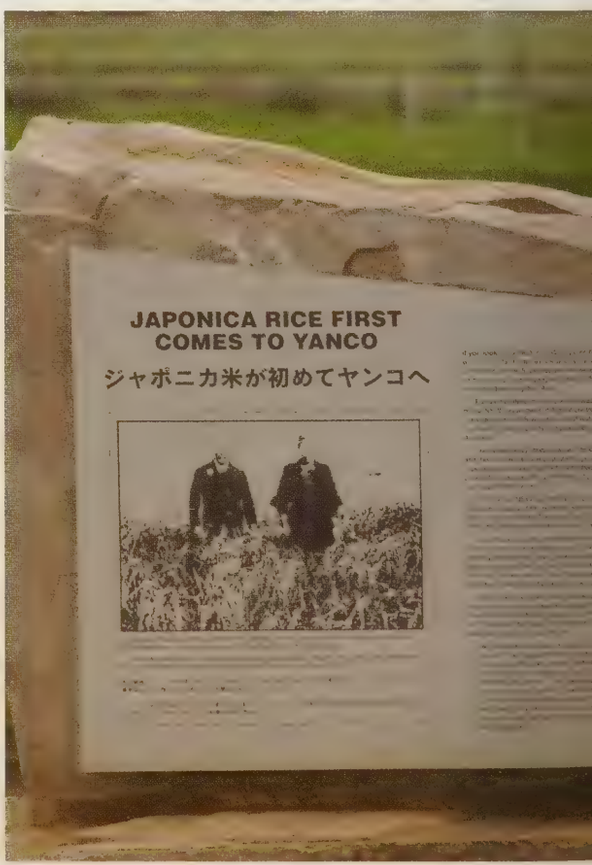
The next step, he says, is to develop varieties that can be established under an aerobic system (in the same way that dryland crops such as wheat are grown) and put standing water on the field only when it's needed most, from around the middle to the end of the growing season.

Cold-tolerance puzzle

The Riverina's temperate climate helps rice growers in several ways. First, almost no rice pests or diseases occur. Second, there's a huge amount of sunlight—almost double that of the wet season in the tropics. And, third, there's a big difference in minimum and maximum temperatures during the summer growing season—hot days and cool nights. This means minimal respiration losses overnight and strong growth during the day. However, sometimes the night temperature falls too far.

"The estimate is that we lose 1 ton per hectare one year in three, and more than 2 tons per hectare one year in 10 to the cold," says Laurie Lewin, Dr. Reinke's predecessor as head of the breeding program at Yanco.

After water-use efficiency, the biggest target for breeders is cold tolerance, which is also linked to water productivity. A body of standing water acts as a thermal blanket, retaining protective warmth when the ambient temperature drops too low. Create a



variety with high cold tolerance, and you cut the amount of water needed throughout the growing season.

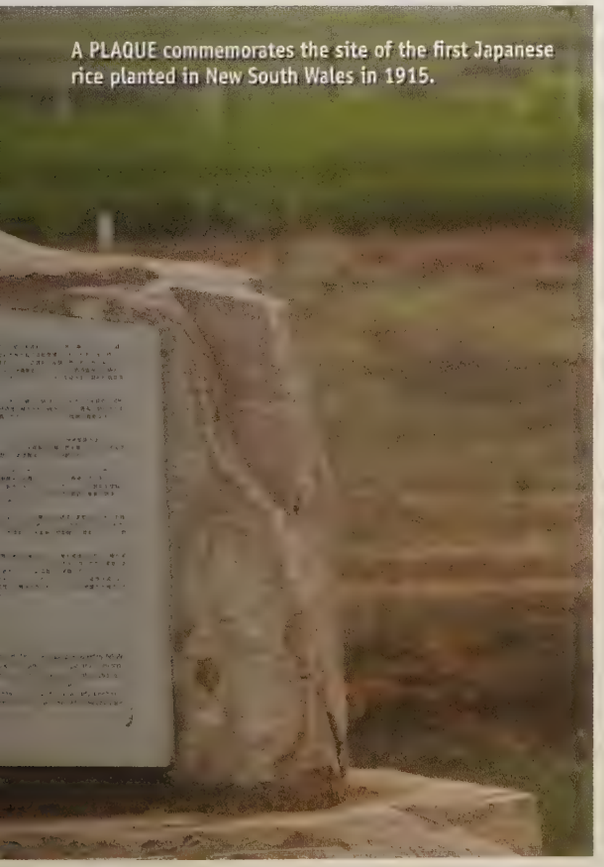
The breeder tasked with cracking the cold-tolerance puzzle is Dr. Snell.

"We've got quite high cold tolerance to start with because a lot of our stock started from Californian material, which is generally tolerant," he says. "But, with up to 30 °C between maximum and minimum temperatures in summer, we want extreme cold tolerance. We're talking about being able to cope with temperatures as low as 10 °C at critical stages of the plant's growth."

Without that sort of cold tolerance, the aerobic rice varieties Dr. Reinke describes will remain nothing more than a nice idea. But, according to Dr. Snell, that may be about to change, with a promising cold-tolerant variety due to be released later in 2010.

Familial bond

Leeton rice farmer Rob Houghton (see *A sunburned grain* on pages 12-17) suggests that the close relationship between growers and researchers is "the reason that the industry is as strong as it is now in such hard times. Geographically, we're in a relatively small area, so it's almost a family



A PLAQUE commemorates the site of the first Japanese rice planted in New South Wales in 1915.

environment. One of the benefits is that any outcomes of R&D are very quickly implemented on the farm. The lines of communication are very crisp, so when there's a new development it's put out there straight away. There's good access to our R&D people, everyone knows who's doing what and there's plenty of opportunity for growers to avail themselves of the latest technologies and theories."

Added to this, the farmers have an excellent relationship with SunRice. In fact, "relationship" is an understatement—the farmers are shareholders in the business, which, as well as handling all processing and marketing operations, guarantees to buy rice at a fair price each season. SunRice also ensures product quality by selling pure seed to every farmer each season, rather than having farmers retain their own seed.

The third relationship in the triangle is between SunRice and the Yanco researchers. Dr. Reinke says, "One of the most productive links we have with the industry is through the people involved in marketing the rice. We get together with them regularly, and we get feedback about what's happening in world markets, what the limitations are in the varieties we currently have, and what markets might want in the future."

Collaborating with IRRI

Dr. Reinke explains that when he first arrived at Yanco, the industry worked with only two principal quality types of rice: long- and medium-grain japonica. Since then, that number has grown to seven. The first stage of the diversification process was the development of a fragrant, soft-cooking long-grain, similar to Thai jasmine rice. This was followed by Arborio-style varieties for use in such dishes as risotto and paella, then soft-cooking short-grain rice aimed at the East Asian market. Next was a firm-cooking South Asian-style long-grain and, more recently, a larger dimensioned medium-grain for the Middle Eastern market.

One unexpected effect of the drought is that several of the Yanco researchers have become involved in international projects—several of which involve IRRI—aimed at improving rice

LAURIE LEWIN, former head of breeding at Yanco.

production in developing countries in Asia. As traditional funding has dropped off, opportunities have emerged through the Australian Centre for International Agricultural Research, which operates as part of Australia's official overseas aid program.

"We maximize our relationship with IRRI at every opportunity," says Dr. Reinke. "Historically, though, it hasn't been easy because IRRI works on tropical rice. I can talk to the breeders there about techniques, but sharing germplasm (plant genetic material) isn't so valuable. But Melissa Fitzgerald's appointment really heralded a new era in linkages with IRRI because, with grain quality, it doesn't matter if it's tropical or temperate. Grain quality and the genes for quality are similar across tropical and temperate varieties of rice."

Securing commercial needs

One of the key roles for Mike Hedditch, general manager, Grower Services for SunRice, is ensuring that the R&D program addresses the commercial needs of the business. Failure to do this, he says, ultimately means a failure to meet the needs of the farmers themselves.

"We supply an enormous amount of our intellectual property to the R&D program," he says. "We're very keen to make sure that the rice breeding and the grain quality programs in particular get the right market signals about the types of varieties they need to develop and about the quality of the grain that consumers want."

John Lacy, industry leader (rice farming systems) at Yanco Agricultural Institute, helps to link the Riverina region's rice farmers with the latest research.

Dr. Ward notes that this type of information informs her work on grain quality. One of her key roles is to supply grain quality data on breeding lines to the breeders.

"The research is largely aimed at expanding the scope of the quality analysis as well as providing such data for earlier gene rations of the breeding process," she says. "Ultimately, this work will fast-track the release of new varieties that have certain agronomic benefits, such as cold tolerance, but are also ready for consumers."

Dr. Reinke pays tribute to his predecessor, Dr. Lewin, who, he says, maintained enough diversity in the Yanco breeding program to allow as rapid a response as possible to new challenges.

"We've strived to have a mix of quality types so that at any point, when some new feature is communicated to us, we can identify material that already exists, and we can leap in and test it," says Dr. Reinke. "That circumvents this 10-year lag phase from making the first cross all the way through to release."

Less water, more rice

By now, it is probably clear that one thread in particular runs through the entire tapestry of rice in Australia: water. Specifically, using less of it to grow more rice.

"Our holy grail in terms of water-use efficiency is to be able to use 10 megaliters of water per hectare," says Ruth Wade, executive director of the Ricegrowers' Association of Australia, a voluntary organization made up of current and retired rice growers (see *A sunburned grain* on pages 12-17). "We were on a nice trajectory in that direction. Before the drought, it was about 12 megaliters, but that's slowed because now it's taking a lot of water to wet up the system. The global average is around 15–20 megaliters. We aspire to consistently being way ahead of anybody else."

Unsurprisingly, much of Yanco agronomist Geoff Beecher's research draws on the same theme. One of his key roles in more than 20 years at Yanco has been in determining land that is suitable for rice production. In particular, this means relatively impermeable heavy clay soils that minimize seepage into water tables. These days, Australian rice growers are permitted to grow rice on suitable soil only. Further, individual farmers cannot grow rice on more than 30% of their suitable land.

More recently, Mr. Beecher has been investigating the way that the spatial layout of rice land affects water productivity.

"In any rice field, we get areas that are highly productive and areas that aren't so productive," he says. "We thought that productivity might have been related to soil type but really it's come back to cut and fill."

Cutting and filling land to make it level have been carried out for decades and, over that time, cutting depth has gradually increased. Around 20 years ago, 10 centimeters would have been considered a big cut; now, some farmers make half-meter cuts.

"Now you've got huge differences in fertility between cut and filled areas," says Dr. Beecher. "If you have a natural topsoil layer with reasonable organic carbon, nitrogen, and phosphorus levels, and you come in and chop it down 400 millimeters, you create an area that's not a very nice growing environment. We're working on how we can manage the problems caused by these really big cuts."

Switching crops

Mr. Beecher is also working on ways of setting up a rice field that allow farmers to switch between crops without having to make major changes.

"We might be looking at a bankless channel with raised beds inside it and a terraced layout," he says, "which means that a farmer could leave the beds in place after a rice crop and then grow a series of upland crops in rotation without changing the layout. So, you can increase cropping intensity and maximize water use at the same time."

John Lacy is industry leader (rice farming systems) at Yanco. He acts as the link between the research and extension

sides of Australian rice to make sure that new information and technologies reach farmers.

Ricecheck system

Mr. Lacy has led the development of the highly regarded Ricecheck system, which uses data from hundreds of farms each season, to keep growers up to date on the most effective crop management strategies. He says that Ricecheck came from a tool he initially developed for wheat farmers.

"I decided that the answers we needed to improve crop management were not in research plots, but were already in farmers' fields," explains Mr. Lacy. "So, I asked, 'If some farmers are getting fantastic yields, what are they doing right?' At that time, rice yields hadn't gone up for 20 years, so we decided to set up a similar system in rice."

Mr. Lacy and several district extension officers selected about 30 farmers who were achieving high, moderate, and low yields. They monitored these closely over two seasons, identifying the practices that led to the greatest success. The system—which takes the form of a simple, short booklet filled with crop management recommendations and a "crop data form"—evolves continually as each year farmers complete the forms and return them to Mr. Lacy, who updates Ricecheck for the next season.

"We still have it running but, with the drought, it's effectively stopped because so many farmers haven't been growing rice," he says. "At one stage, when there was a lot of rice around, we were getting up to 700 farmer records annually, which is an enormous database."

Thus, the lack of water in the Riverina is hindering extension work as well as research progress. Like the researchers, though, Mr. Lacy sees a bright future.

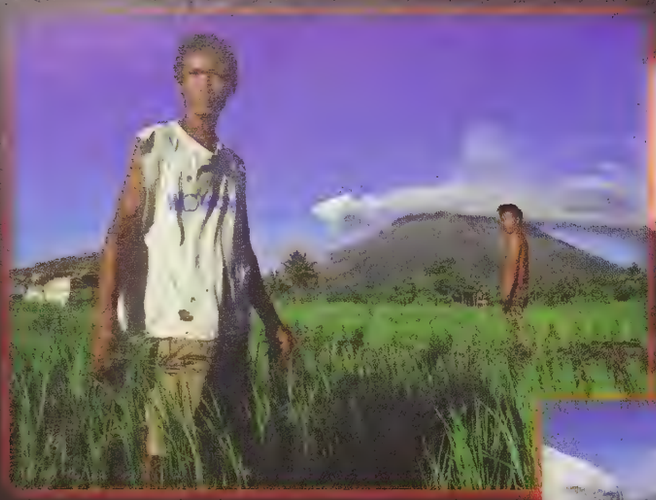
"As soon as this drought finishes—and it will—and we get back to more normal seasons," he says, "our research and extension programs can get back to normal and we can get back to making the same progress we were making before."

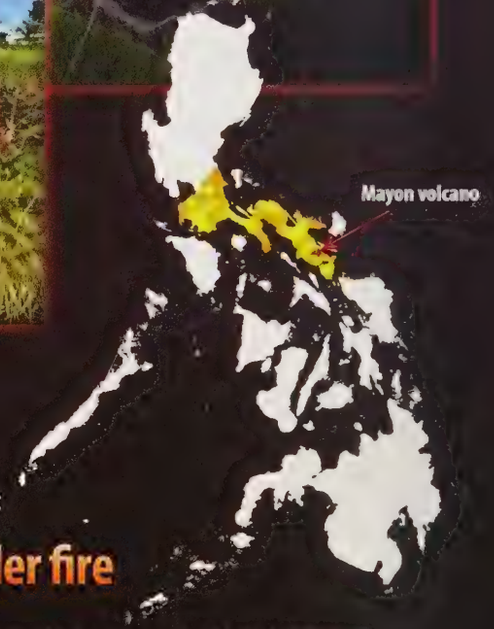
RICECHECK, DEVELOPED by Yanco farming systems expert John Lacy, helps rice growers improve their production by distilling the most successful practices of the farmers themselves (*right*).

WITH FUNDING for rice research linked to production, the 8-year drought has wreaked havoc at Yanco Agricultural Institute, which currently cannot afford to run all of its lab equipment (*below*).

DUST, SYMBOLIZING the drought of the last 8 years, swirls over one of Yanco Agricultural Institute's experimental fields.

A farmer takes time to tend his rice farm while the Mayon volcano, for now, peacefully "watches" over the rural village of Albay, Bicol, Philippines (see *Courage under fire* on page 26).





MAYON REVISITED:

Courage under fire

A photo update by **Isagani Serrano** and **Chris Quintana**

In Bicol Province of the Philippines (see yellow on map), with its more than 300,000 hectares of land dedicated to rice farming alone, calamities such as the Mayon volcano's eruptions and raging storms translate into huge losses—almost 30,000 sacks of rice in just one cropping season. Yet, despite these devastating circumstances, farming communities continue to thrive. The people of these villages have learned to calmly slip back into their daily routines and courageously face these calamities as part and parcel of their daily lives. For a region often rocked by Earth's fury and flooded from the sky, it is no wonder that its people have characteristically been known as *oragon*—a local term that captures their tenacity and resilience in the face of adversity.

Editor's note: In October 2006, *Rice Today* featured the Mayon volcano and how the changes in its mood affect the farming community in Bicol, Philippines (see *Rice in harm's way* on pages 24-27 of *Rice Today* Vol. 5, No. 4), and again in January 2007, when the rains of Typhoon Durian dislodged tons and tons of Mayon's volcanic ash into the rice fields and villages below (see *Once were rice fields* on pages 20-25 of *Rice Today* Vol. 6, No. 1). When the volcano started grumbling again late in 2009, our team of photographers returned to capture its fits of temper, as well as the struggle of the people who continue to live under the "moody" volcano's shadow.

On the front lines

by **Leah Baroña-Cruz**

A Filipino farmer contends with climate and looks to science

Climate change is on the agenda of many agricultural organizations and experts are drafting battle plans on every front. But what do farmers—the biggest stakeholders in the game—have to say?

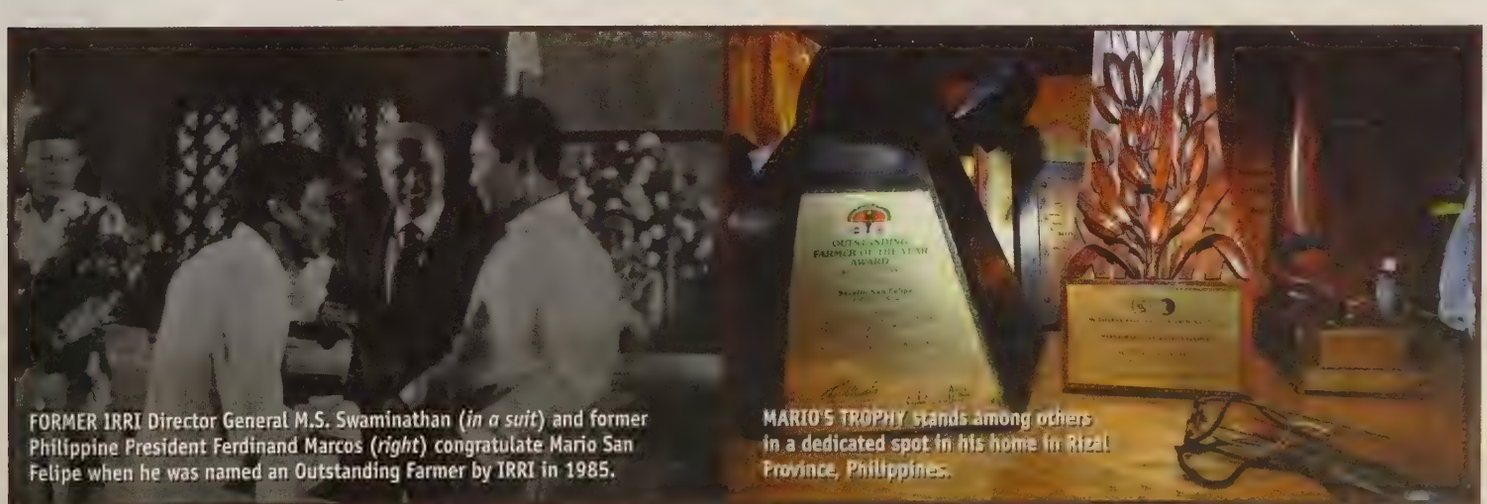
About a month after Typhoon Ketsana ravaged Luzon Island in the Philippines (see *Drowned harvest* on page 40 of *Rice Today* Vol. 8 No. 4), *Rice Today* went to the town of Morong in Rizal Province to check on a particular rice farmer whose history is tied to the International Rice Research Institute.

Serapio "Mario" San Felipe, now 75, was one of 14 Outstanding Farmer awardees selected by IRRI from 10 countries on the occasion of the Institute's 25th anniversary in 1985 (see http://snipurl.com/v46k3 and *In the Punjab—an outstanding farmer revisited* on pages 34-35 of *Rice Today* Vol. 8 No. 2). He and his wife, Melba (who died from a stroke in 2002), raised their six children out of the production of their rice farm, which they do not even own.

"Among all those Outstanding Farmers, I was the only one who did not own the land I till," Mario says, without apologies. "Our children's education was the priority."

The 3.8-hectare farm that Mario still tills in a rice-sharing arrangement with the landowner is along the coast of Laguna de Bay (see Google maps at http://snipurl.com/v46zm), the largest lake in the Philippines. Although the lake is a generous source of irrigation water during the rainy season (May to October), the water level often rises and floods a good part of Mario's land.

Once in a while, as if monsoon rains are not enough trouble, a typhoon picks up extra moisture from the Pacific and drops sheets of it on the first land masses it touches—more often than not, the islands of the Philippines. Typhoon



FORMER IRRI Director General M.S. Swaminathan (*in a suit*) and former Philippine President Ferdinand Marcos (*right*) congratulate Mario San Felipe when he was named an Outstanding Farmer by IRRI in 1985.

MARIO'S TROPHY stands among others in a dedicated spot in his home in Rizal Province, Philippines.

Ketsana, which struck on 26 September 2009, dumped a month's worth of rain in just 6 hours. Large parts of Metro Manila and surrounding provinces were inundated. Laguna de Bay overflowed into residential areas and rice fields, including Mario's, along its coast. In most of these areas, the water did not recede until 2 months later.

Mario concedes that the biggest of his farm management problems are neither pests nor diseases but extreme weather events, which he maintains are nothing new. He recalls three instances over the last 40 years or so during which unusual heavy flooding invariably destroyed much of his rice crop for the season: 1972, 1978, and in September 2009 when Ketsana came and ravaged the country's ripening rice fields. Records show that similar floods in the region also occurred in 1919, 1934, and 1941.

Despite these extreme events, Mario declares he does not buy the idea of climate change. "These are quirks of climate," he shrugs. He says that since the climate has never really been constant to begin with, farmers must learn to adapt and adjust to it.

He also remains skeptical of declarations from authorities claiming that the rise in the water level of Laguna de Bay is being caused by the network of fishponds along the coast and squatters' dwellings built along the channels radiating from the lake—both of which slow down outflow from the lake and impede natural drainage to Manila Bay. "I was born here, and I know how the water behaves," he insists.

Mario has always tried new technologies from IRRI. He was the first farmer in the Laguna de Bay area to plant IR8 in the mid-1960s and, to this day, he remains loyal to IRRI-bred varieties. Back in 1985 when he was honored at IRRI, he asked IRRI scientists to find a solution to the salinity problem—a major concern of rice farmers around the lake. His face lit up when he learned that IRRI is indeed now field testing its salt-tolerant varieties.

It is for farmers like Mario, as well as others around the world who have felt or are yet to feel the sting of extreme climate events, that IRRI's stress-tolerant rice varieties (be they for flooding, salinity, or drought) will make a significant impact. The struggle for food security goes on and undoubtedly new constraints to production will come along. But, one thing farmers can bet on is that scientists will continue to do what they can.

ABOVE, MARIO stands on a portion of his rice farm along the coast of Laguna de Bay that escaped the deluge brought by Typhoon Ketsana in September 2009. Most areas had it worse, such as this adjacent farm in which the near-harvest rice crop had no chance of bouncing back after floodwaters receded a month later.

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Mapping genebank co

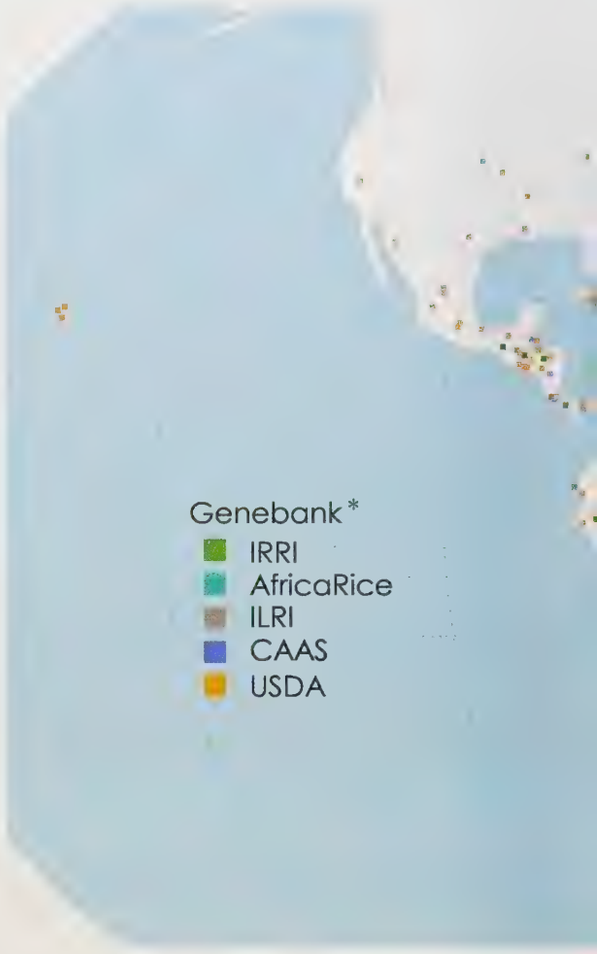
The genetic diversity in traditional and modern rice varieties, and in the wild relatives of rice, is vital to agricultural development, as it provides the basis for rice improvement. Sometimes, a single rare gene found in only a few varieties can greatly contribute to rice production. A good example of this is the short-straw gene or the *SUB1* gene that confers submergence tolerance.

Ironically, the success of rice breeding has rapidly replaced traditional varieties with modern ones, particularly in Asia's irrigated rice fields. Thus, the use of crop diversity bites its own tail, becoming a threat to its persistence. One important approach to avoid the loss of crop biodiversity, or "genetic erosion," is the use of genebanks. A genebank assembles a broad collection of rice varieties and conserves them for breeding. In total, there are 780,551 samples of rice in genebanks. The International Rice Research Institute (IRRI) has 109,136 samples, while genebanks in India and China have 86,119 and 70,104 samples, respectively.[1]

The samples in genebanks, and their associated data, can also be used to further explore and discover geographic patterns in crop diversity. In fact, these patterns are used to reconstruct the prehistorical origins and spread of crops. These data can be used to narrow down the geographical search area in finding samples with important traits, such as a certain type of disease resistance. The data also serve to identify gaps in a genebank collection, for which collecting expeditions are still needed.

Such analyses are possible only if we have a decent database in which each sample is described. Crop descriptors can include morphological characteristics, agronomic traits, and genetic data. For geographic analysis, it is crucial also to know where the sample was taken from.

Fortunately, "passport" information such as name of species, common name, institute code, date of acquisition, and location is generally available in genebank databases. However, for many samples, no geographic coordinates are available. Most samples were collected before the global positioning system became available. So, their locations were simply expressed in text format. At IRRI, we have worked on improving this situation to refine the Institute's genebank and also other genebanks. We have used tools such as biogeomancer[2] to assign coordinates to genebank samples, using their available text description as references. This is called "georeferencing" (see box). We also cross-checked the coordinates and corrected those that were found to be wrong.



Georeferencing. This refers to the process of converting text descriptions of locations to geographic coordinates that can be used in an analysis. This involves breaking down a description such as "14 kilometers north and 2 kilometers west of La Paz, Tarlac, Luzon, Philippines" into its geographic components, which can then be used to assign a coordinate to the record—in this case, 15.578N, 120.704E. However, processing such information is not always as straightforward as this example. Records often struggle with variations in spellings, obsolete names, and sometimes misspelled entries.

Dealing with inaccurate or wrong location data. Records that do have location data are also checked for errors. Some common errors are mistaking longitude for latitude (a mistake probably made from time to time); swapping east with west or north with south; missing a latitude or longitude coordinate; truncating the decimal points in a coordinate, resulting in lower precision; or simply putting in the wrong data. Not all errors can easily be corrected, but we have corrected those coordinates that fell in an ocean, or in the wrong country. Needless to say, determining the most likely location for an accession is a time-consuming task.

[1] According to "The State of the World's Plant Genetic Resources for Food and Agriculture," FAO, 2009. Available at www.fao.org/ag/AGP/agps/PGRFA/wrlmap_e.htm.

[2] Guarlnick et al. 2006. PLoS Biology. www.plosbiology.org/article/info:doi/10.1371/journal.pbio.0040381; http://bg.berkeley.edu/latest/.

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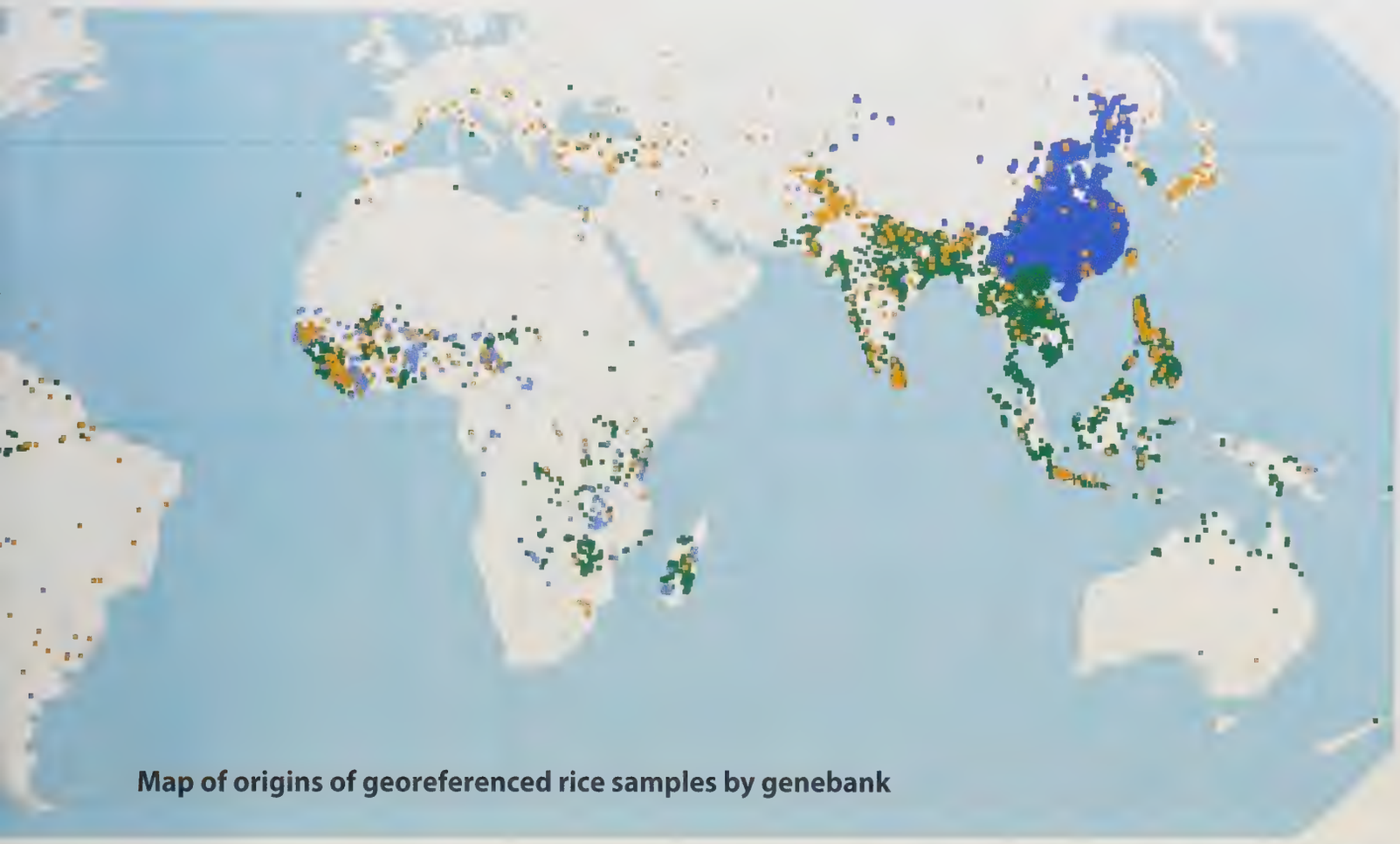
by **Ma. Cristina Paule, Jane Girly Cuerdo, Mary Anne Reyes, Arnel Rala, Jacob van Etten, Andrew Nelson,** and **Robert J. Hijmans**



Map of origins of georeferenced rice samples by genebank

***IRRI** = International Rice Research Institute, **AfricaRice** = Africa Rice Center (formerly known as WARDA), **CAAS** = Chinese Academy of Agricultural Sciences, **USDA** = United States Department of Agriculture, **ILRI** = International Livestock Research Institute.

We have now almost completed georeferencing the IRRI collection. This map illustrates the progress we have made so far. We have also included data for some other rice collections.[3]

The coverage of the rice collections reflects the global distribution of rice cultivation and diversity, which were found to be highest in East, Southeast, and South Asia, and in West Africa (see map), as well as in the regional focuses of the institutes with rice genebanks (most samples in the genebank of AfricaRice are from West Africa).

An important question is whether or not there are still gaps in the results of this impressive collecting effort. That is hard to say because the data presented were taken from just a limited number of genebanks, not all, and some records did not have coordinates. Further analysis must also be done to incorporate genetic and other data to include the relative importance (contribution of additional diversity) of new sites. Nevertheless, some gaps stand out. In the collections mapped here, very few samples came from Japan and Korea (but these countries have genebanks of their own). Collections in parts of Myanmar and Cambodia are also sparse.

The process of georeferencing these key rice accession databases continues and we aim to produce a complete picture of global rice diversity soon, as it will certainly play a crucial role in the conservation and management of rice genetic resources for future generations.

Ms. Paule, Ms. Cuerdo, and Ms. Reyes are researchers; Mr. Rala is an associate scientist; and Dr. Nelson is a geographer in IRRI's Geographic Information Systems, Social Sciences Division. Dr. van Etten is an assistant professor, School of Biology, IE University in Spain, and Dr. Hijmans is an assistant professor, Department of Environmental Science and Policy, University of California-Davis.

[3] This work was supported by the GPG2 project (World Bank/Bioversity) and by the United States Department of Agriculture.

TODAY, INDIGENOUS African rice is grow only by a few farmers in isolated areas of West Africa.

Pockets of gold

by **Savitri Mohapatra**

Scientists find a treasure trove of information in Africa's indigenous rice that could help breed better varieties for tomorrow's generation

On the Danyi plateau in Togo, villagers still bless newly-wed couples by sprinkling rice grains over their heads. They use indigenous African rice, which was domesticated about 3,500 years ago in West Africa. The villagers also continue to appease the souls of their ancestors by offering them this rice.

African rice is not only an integral part of the culture but also the preferred food. "Once you taste our rice, you will never like any other rice and it stays in your stomach unlike the modern varieties," the women say. The elderly villagers mourn, however, that their children and grandchildren are no longer interested in growing this rice.

According to some historians, African rice sustained the great empires of Ghana, Mali, and Songhai in West and Central Africa during the 11th to 16th century. Today, however, this type of rice is becoming extinct as it is grown only in pockets of West Africa. In some areas, the deepwater or floating rice plants belonging to this species are still found.

African rice, whose scientific name is *Oryza glaberrima*, is unique to Africa. About 450 years ago, the Asian species, *O. sativa*, was introduced to Africa from Asia and quickly became popular because of its high yield potential.

Over the years, African rice has been replaced in the region by Asian rice because it is prone to lodging (plants fall over) and shattering (the panicle scatters seed at maturity). For years, it has also been neglected by research.

However, new findings presented by Africa Rice Center (AfricaRice) scientists and their partners during the Africa Rice Congress held last 22-26 March 2010 in Bamako, Mali, have sparked renewed interest in this species.

A few African farmers, such as the villagers in the Danyi plateau, have continued to grow African rice because of its adaptability and its ceremonial and cultural value. These farmers inspired AfricaRice scientists to investigate the species and tap into its rich reservoir of genes for resistance to several stresses, including weeds.

For example, studies have shown that one of the *O. glaberrima* varieties, CG 14, is weed competitive and has

good resistance to iron toxicity, drought, nematodes, waterlogging, and major African rice diseases and pests. It seems to adapt to acid soil with low phosphorus availability.

"Such multiple resistance to indigenous constraints is a highly desirable character for rice cultivated in the rainfed ecology in West Africa by resource-poor farmers, who cannot afford to adopt intensive agronomic measures against such constraints," said Dr. Moussa Sié, senior rice breeder and coordinator of the Rice Breeding Task Force of AfricaRice.

That is why AfricaRice scientist Dr. Monty Jones and his team selected CG 14 when they decided to cross *O. glaberrima* with *O. sativa* in the 1990s to develop productive rice varieties that can adapt to African conditions. They succeeded in breaking the natural barrier that makes it difficult for the two species to cross. This was the genesis of the New Rice for Africa (NERICA). The best NERICA varieties combine the stress tolerance of *O. glaberrima* with the high yield potential of *O. sativa*.

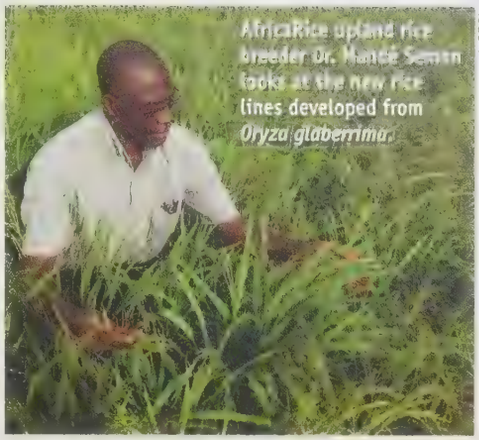
"However, there are still gaps between the NERICA varieties and *O. glaberrima* in relation to resistance to some local constraints," Dr. Koichi Futakuchi, AfricaRice ecophysiologist, observes.

AfricaRice therefore started to systematically characterize its entire *O. glaberrima* collection of 2,500 samples in 2009. A special effort is being made to screen for major diseases and environmental stresses such as acidity, iron toxicity, cold, and salinity.

Explaining this comprehensive effort, Dr. Kayode Sanni, coordinator of the International Network for Genetic Evaluation of Rice for Africa (INGER-Africa), says that until now only a few accessions of *O. glaberrima* have been used in the breeding programs.

"By characterizing our *O. glaberrima* collection in our genebank, we may find new *O. glaberrima* lines with better traits than the current parental lines of NERICA," Dr. Sanni says.

AfricaRice is also changing the breeding concept as well as breeding procedures to develop new interspecific varieties. "The new concept for interspecific breeding between *O.*


AfricaRice upland rice breeder Dr. Mandé Semon looks at the new rice lines developed from *Oryza glaberrima*.

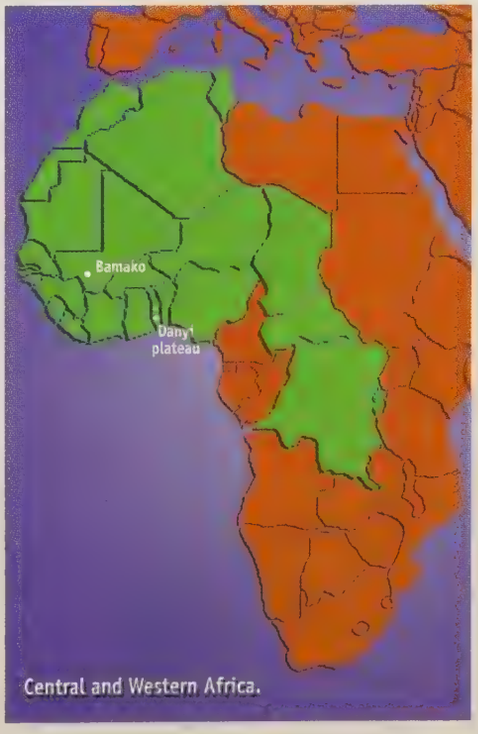
K. OROU

glaberrima and *O. sativa* is to combine the adaptability of *O. glaberrima* to local environments with the optimal conjunction of the best traits of the two species in relation to yielding ability," says Dr. Futakuchi.

Studies made by Dr. Futakuchi and his colleagues show that the *O. glaberrima* parent of the upland NERICA varieties, CG 14, even produced more panicles than the "panicle-number type" high-yielding *O. sativa* varieties, although its individual panicle was smaller. The introduction of such an extraordinary trait may favor yielding ability.

Such studies increasingly recognize the "need to exploit the treasure trove that is in African rice germplasm," as AfricaRice upland rice breeder Dr. Mandé Semon puts it.

Dr. Semon is leading the effort to obtain interspecific hybrids that have



Central and Western Africa.

more *O. glaberrima* genes in the genome than the current NERICA varieties, which were developed from backcrossing to an *O. sativa* parent. "We are using interspecific bridge lines in crosses with *O. glaberrima* and *O. barthii* and no backcrossing has been done with the *O. sativa* parent," he explains. "The progenies will be ready for field testing soon."

To better exploit the assets of *O. glaberrima* without being hampered by the sterility problems of hybridization with another species, AfricaRice scientists have begun working on the intraspecific breeding of *O. glaberrima* and are taking steps to develop plants that are less prone to lodging and shattering.

Since *O. glaberrima* had been considered to have generally low yield potential, interspecific hybridization with *O. sativa*, which has high yield potential, was a major method in using this species. However, AfricaRice breeders now think that *O. glaberrima* can potentially yield 5–6 tons per hectare, which is sufficient for rainfed rice ecosystems in Africa.

Initial results from crossing different types of *O. glaberrima* also show that completely different sets of genes are responsible for tolerance of submergence, rice yellow mottle virus, and phosphorus deficiency in soils from those in *O. sativa*.

Some new products will likely be derived using molecular breeding approaches, through collaborative efforts with the International Rice Research Institute and Chinese Academy of Agricultural Sciences. AfricaRice scientists are already using this approach to introduce resistance to disease and other stresses into some of Africa's most popular rice varieties.

With Cornell University in the U.S., a single nucleotide polymorphism (SNP) chip is being developed based on core collections of *O. glaberrima* and *O. barthii*. This chip can efficiently analyze African germplasm and screen interspecific progenies for desirable traits.

"We have new products in the pipeline for Africa's rice farmers, particularly those who want to continue to grow African rice–like those of the Danyi plateau," says Dr. Sié.

Made for the TROPICS

by Kyung-Ho Kang

CHRIS QUINTANA (3)

Traditionally grown in cooler regions, japonica varieties, which are developed by IRRI, can now be cultivated under the warmer climate of the Philippines

Rice is more than a staple food in Asia. It is ingrained in the culture—not to mention adapted to the topography and climate of particular countries—that sometimes respective ethnic groups can be distinguished from each other based on the type of rice they grow and eat. While South and Southeast Asians, for example, prefer long-grain rice such as basmati and jasmine, Northeast Asians prefer medium-grain rice, known as japonica. This latter type of rice thrives in temperate areas. Hence, in countries where it is not traditionally grown, consumers need to pay more to obtain it.

This may soon change, however, as the International Rice Research Institute (IRRI) has recently developed two temperate japonica rice varieties released in the Philippines. The Rice Technical Working Group of the National Seed Industry Council through the National Cooperative Tests Network, led by the Philippine Rice Research Institute, has approved two temperate japonica rice cultivars, NSIC Rc170 or IRRI 142 and NSIC Rc220 or IRRI 152, for large-scale planting. This development is expected to provide local farmers with higher returns, and subsequently, allow consumers to enjoy this quality rice at a more affordable price.

Adapting to the tropics

IRRI's japonica rice breeding program, which is now known as Germplasm Utilization Value Added (GUVA), started in 1991, in collaboration with the Republic of Korea, to develop high-quality, high-yielding temperate japonica rice cultivars that can adapt and grow in the tropical zone. Under warm conditions, most temperate japonica rice varieties show stunted growth and develop weak tillers, small panicles, and premature heading because these varieties are sensitive to short daylength and high temperature. So, during the initial stage of the breeding program, every year, scientists identified and selected, from the Korean Seed Multiplication Project's nursery, germplasm (plant genetic material) that showed good performance in the Philippines. These selections served as base materials to develop breeding populations of temperate japonica rice that can adapt to tropical conditions. They were found to be less sensitive to longer exposure to sunlight and higher temperature, and also did not differ much in plant growth under the varying environments of Korea and the Philippines.

The first of the two cultivars in the Philippines, NSIC Rc170 or IRRI 142, now called MS11, was released in 2008. MS11 is a cross between two varieties from the Republic of Korea, namely, Jinmibyeo and Cheolweon 46. Jinmibyeo has high grain quality, while Cheolweon 46 has high resistance to pests and diseases in tropical conditions. The product, MS11, is a semidwarf (90 cm), early-maturing (112 days) variety, and has the typical characteristics of japonica grain—short rounded shape, low amylose content (15.5%), and low gelatinization temperature. In the three-season multilocation trials from the wet

seasons of 2001 to 2002, MS11 yielded an average of 4.5 tons per hectare, with a premium milling and head rice recovery of 70 and 61%, respectively.

The second temperate japonica rice, NSIC Rc220 or IRRI 152, was released in 2009. Locally known as Japonica 1, this cultivar is also a semidwarf (89 cm), early-maturing (109 days), and high-yielding variety. Again, in three-year multilocation trials conducted during the wet seasons of 2007 to 2008, it demonstrated a 25% greater yield advantage over MS11. And, strikingly, it was evaluated to have better eating quality—comparable with that of the highly regarded Koshihikari, a japonica rice widely grown in Japan.

Contributions of japonica rice

Historically, japonica rice has had a profound impact on rice breeding in Asian countries. IRRI produced IR8 from a cross between a Chinese japonica variety, Dee-geo-woo-gen, and an Indonesian variety, Peta (see *Breeding history* on pages 34-38 *Rice Today* Vol. 5 No. 4). As a result, this raised the yield potential of rice from a mere 2–3 tons per hectare of the traditional varieties to 8–10 tons per hectare—and later led to Asia's Green Revolution. Moreover, the development of the high-yielding Tongil-type rice cultivars by crossing japonica with indica has helped Korea achieve and sustain its rice self-sufficiency status since 1972.

Besides increasing rice productivity, japonica rice has been used for a wide range of gene sources to improve cold tolerance, grain quality such as grain shape, amylose content, gelatinization, resistance to diseases such as blast and bacterial leaf blight, plant stature, and leaf senescence, among other traits.

Now, many elite temperate japonica lines adaptable to tropical climate are being developed at IRRI through the GUVA program. These lines are expected to provide base materials for intersubspecies hybridization to develop intermediate varieties. These intermediate varieties will be another breeding goal for the GUVA program to achieve genetic improvement for yield potential, canopy architecture, lodging tolerance, and resistance to major pests and environmental stresses that currently pose a threat to the temperate japonica varieties' growth in tropical conditions.

Growing taste for japonica

With the release of the two japonica rice cultivars, a growing taste for japonica rice in the Philippines, especially among urban dwellers and the younger generation, will soon be satiated at more reasonable costs. Korean, Japanese, and Taiwanese restaurants and hotels would no longer need to look back to their origins to cater to their customers' preference. Most importantly, local farmers who grow this type of rice could soon take advantage of the expanding market, reap higher profits, and, we hope, lead better lives.

Dr. Kang is a plant breeder in IRRI's Plant Breeding, Genetics, and Biotechnology Division.

A PANICLE of a japonica rice cultivar, MS11.

IRRI PLANT breeder Dr. Kang and visiting research fellow Dr. Jeung-Hee Lee closely examine ripening japonica rice.

Operation 20/20: The clear path to a sustainable food supply.

The International Commodity Institute (ICI) is launching a new, five-point initiative to bring the world closer to food security. *Operation 20/20: The clear path to a sustainable food supply* will be the driving force behind the ICI Annual Partner Program, to be launched in 2010, in conjunction with IRRI's 50th anniversary celebration. President and CEO of ICI, Mr. Jeremy Zwinger, firmly believes that the private sector must partner with research initiatives that help feed the world. Zwinger says, "It often takes one decade for an investment in agricultural research to come to fruition by way of increased yields, new technology, or a host of other possibilities. Therefore, it is imperative that more business and global leaders actively participate in funding research to positively impact future generations."

Zwinger believes that launching *Operation 20/20* in 2010 has both strategic and intrinsic benefits to ICI, as well as ICI Annual Partners. *Operation 20/20* is a 10-year program with defined goals that will aid in the progress of global food security, specifically as it relates to rice. The five points that will drive this initiative are:

One: *Rice Today* is the world's premier rice research journal distributed in more than 100 countries on a quarterly basis. *Rice Today* highlights rice research developments in emerging and developed economies to produce a sustainable and economically viable food supply. ***Rice Today*** **helps secure tomorrow's food supply today.**

Two: *The Rice Trader* is the world's authoritative voice in the global rice trade. This weekly publication distributed to clients around the world tracks global rice movements, supply and demand economics, as well as political actions that directly affect the price of the world's most widely consumed grain. This critical newsletter provides risk management strategies and strategic insights that benefit global trade.

Three: *ICI World Conferences* facilitate interaction among government officials, business leaders, and other members across the rice industry supply chain. These meetings, held twice a year, one in the Western Hemisphere and another in the Eastern Hemisphere, highlight concerns, developments, and economics surrounding the global rice industry.

Four: *The Ariel Society* was founded to highlight a sustainable approach to rice cultivation and showcase its benefits as a food. This society believes that sustainability is more than good stewardship of natural resources through agricultural cultivation and culinary practices. Sustainability extends to feeding the hungry, caring for the poor, and investing in our future generations.

The Ariel Society

Five: *Farm and Trade Inc.* is a trusted broker and advisor for the international commodities trade. Farm and Trade Inc. is an international buyer and seller of rice with a vested interest in uniting sustainable cultivation and research techniques with ethical trade decisions. By combining world-class analysis from all corners of the industry, Farm and Trade Inc. is the world's premier broker of rice. **From field to fork, we have you covered.**

By partnering with the International Commodity Institute, your organization will be on the forefront of progress for a sustainable food supply. An ICI Annual Partner receives the benefits of being featured in *Rice Today,* the ICI World Conferences, and a host of other opportunities. By combining research, production, and trade, Operation 20/20 is the clear path to a sustainable food supply.

Join the solution and partner with us now. Find out more by contacting logan.wilson@thericetrader.com.

A juggling act:
Gender barriers and molecular maps

Susan McCouch, an associate geneticist at the International Rice Research Institute (IRRI) in 1990-94 and currently professor of plant breeding and genetics at Cornell University, was truly a pioneer—in more ways than one. She was an integral part of the team at Cornell that developed the first-ever molecular map of rice while, at the same time, being among the first female scientists to break the gender barrier in agricultural research. Back in 1985, when she applied to be a graduate student in Cornell's plant breeding program, she was placed on probation because she was a female with a young child. Even so, during her July 2009 interview on the Cornell campus, she pointed out that, although she experienced difficulties and challenges as everyone does, she didn't really believe that hers at both Cornell and IRRI were centered on gender issues.

Finding meaningful work in the developing world with rice

I ended up at IRRI in a quite roundabout way. I actually came into science late in my career. I had lived and traveled extensively in Latin America before coming back to the United States for graduate school. I had realized that my background in literature and history wasn't going to give me the tools that I needed to find meaningful work in the developing world, which was one of the aspirations I had.

So, I returned to the United States with interests in agriculture, nutrition, food supply, and health (but not necessarily medicine). That range of interests converged on the field of agriculture and specifically on rice as a staple food. Access to food was the understory for a lot of the nutritional problems and nutrient deficiencies that I had seen during my travels.

At the time I entered graduate school, I didn't know that I would be able to study something so well-suited to my interests. I entered the PhD program in plant breeding and genetics at Cornell University as an older person, after my first child was born. I had deferred to my husband's career preparation first. By that time, we were thinking very hard about how we could "architect" a life that would give us both professional opportunities in the developing world.

Being female with a young baby forces probation

While my husband, Paul Coen, was in veterinary school, I was a staff technician at Cornell. During that time, I took a very well-known international agriculture course. Through conversations with many participants during that course, I concluded that I wanted to do graduate work in plant breeding. It had not occurred to me before but it fit very well with many of the interests I had, and with my MS preparation in plant pathology.

In 1985, when I applied to the field of plant breeding at Cornell, it was the first time that a female with a young baby was accepted to become a graduate student. Several of the professors felt it was too great a handicap, and that I would never work in the field. I think they felt that, maybe, I was going to attend classes, get an education, but never work professionally. So, I was accepted on probation and I had to prove myself. Despite the fact that many of the male students in the department had young babies at home, this was not grounds for questioning their professional aspirations. But, anyway, I entered the department and I worked very diligently and I think I demonstrated a serious commitment.

My timing was really fortunate because the Rockefeller Foundation's Program on Rice Biotechnology had

IN 1990, Dr. McCouch and laboratory technician Marifa Lanuang Corral use liquid nitrogen to harvest tissue from IRRI field plot–grown rice plants for DNA extraction.

just started in 1985. Ray Wu [the late Cornell professor of molecular biology and genetics, who was widely recognized as one of the fathers of plant genetic engineering], Ronnie Coffman [IRRI plant breeder, 1971-81 and currently director of Cornell's International Programs], and Cornell plant breeder Steve Tanksley had put forward a proposal to do some molecular biology on rice that would involve developing, in those days, an RFLP [restriction fragment length polymorphism] map. So, as I entered the department and considered the various opportunities that presented themselves as PhD projects, this was the one that stood out in my mind. Initially, I was told that I didn't have the qualifications to take on that project. But I slowly worked my way into it and, after the first year, was selected for a fellowship under that program. So, my PhD program was largely funded by the Rockefeller Foundation.

Great teamwork—developing the first molecular map of rice

I became a full-fledged graduate student in 1986. During that time, I worked very closely with two Chinese colleagues [Z.H. Yu and Z.Y. Wang] who were also Rockefeller-funded scholars. Our threesome—the two scholars and I—put together that first RFLP map of rice, which was published in 1988 [*Theoretical and Applied Genetics*: Molecular mapping of rice chromosomes, 76:815-829]. It was a great achievement derived from teamwork. We learned a lot from Steve Tanksley, a tomato geneticist, who was making his first foray into cereals, specifically rice. The RFLP technology, as those who worked with it know, is cumbersome and very tedious. It involved a lot of work using radiation and almost a 24-hour routine in the lab. We worked day and night to develop this map, and it was a great accomplishment in its day—135 markers across rice's 12 chromosomes. Anyway, it was the first molecular map of rice, very historic, and we were very excited.

I made my first trip to IRRI to present the results of that work in 1988. I remember being stunned by the number of researchers at IRRI in so many diverse fields, all of them concentrated on rice. I was excited by it all. I think people were equally excited by the work we were doing at Cornell. There was a very good synergy and I think that first visit cemented a relationship that would evolve into a job opportunity at IRRI when I finished my PhD.

The IRRI experience

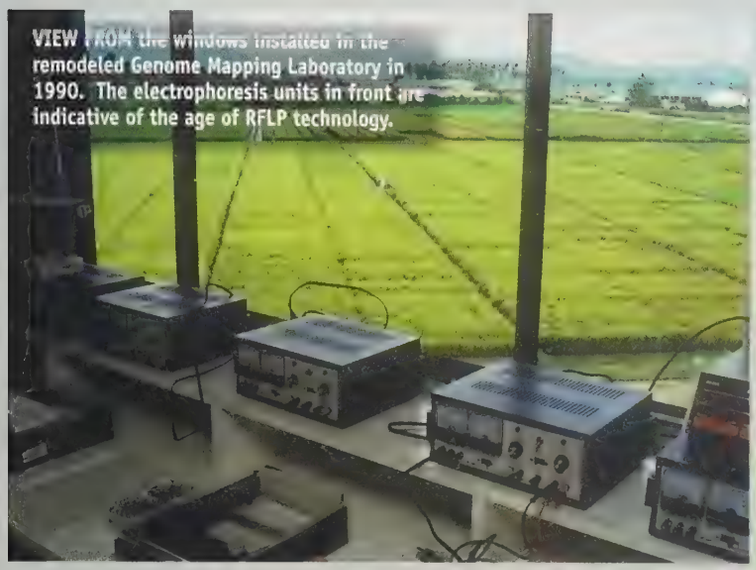
In 1990, when I received my PhD from Cornell, I had just given birth to my second child, Andre. When he was about 8 weeks old, the family moved to the Philippines so that I could take up a position as an internationally recruited geneticist at IRRI. My first task was to set up a molecular breeding lab—a historic first.

We were on the cutting edge of the technology based on what we had developed at Cornell, and we were going to try to implement it at IRRI, putting the molecular markers into action in the context of plant breeding—and in the context of rice improvement for the developing world. For me, it fulfilled my dream of combining science—and the excitement of the new kind of science that was just emerging at the time—with the frontier of developing new varieties of rice. We aimed to encourage better use of the natural resources that were available to people. Of course, the other underlying theme was: could we use genetics to minimize the amount of pesticide use and improve fertilizer efficiency? Today, we're very interested in water-use efficiency as well.

Creating excitement overcomes resistance. All of this came together in this wonderful career opportunity. I think that my family really appreciated what it meant to me, after 4 years in the PhD program, to have the chance to go to IRRI and try to integrate the new genetic tools into the breeding process there—it was something that required as much interpersonal and political will as scientific expertise. During the early days, there was a fair amount of resistance to spending time and money on using molecular markers to do something that the breeders thought they already did very well. There was a time when the new technology was both embraced and resisted, and a little bit resented. I was right at that edge. So, I did my best to try to introduce the technology in ways that would allow others to share the excitement of what I believed was possible when these markers were used to identify genes controlling the traits that breeders selected for.

And so, for the last 20 years, that is what I have spent my life doing. We've continued to use a participatory approach. I've tried to bring people from diverse backgrounds into the process and share the excitement of what science has meant to me. At the same time, I've tried to learn from others where the most pressing problems lie and to address those problems using germplasm and natural variation that is of most interest to them. This has always been a combined effort to show others what was possible and to use genetics wisely for plant improvement.

Greatest achievement: Genome Mapping Laboratory. I think my greatest achievement at IRRI was developing that first marker lab—I think it's still called the Genome Mapping Laboratory [now referred to as the Molecular Breeding Laboratory]. This program has been modified and enlarged and now occupies a central place in the breeding program. Just thinking back to what it meant to pioneer such a program, I remember the very first look



VIEW FROM the windows installed in the remodeled Genome Mapping Laboratory in 1990. The electrophoresis units in front are indicative of the age of RFLP technology.

THE FAMILY—Andre, Susan, Amanda, and Paul—lived in off-campus housing in 1990-91 because they wanted to get more involved with the local Filipino community.

I had at what the space would be—there were no windows; it was just a brick building with a garage underneath. I said: "I think the first thing we need to do is to put in windows so we can look out on the rice paddies and the beautiful volcanic mountains in the background." Indeed, we insisted on that. I still walk into that laboratory and remember the decision to put in the windows that was part of designing the facility. To see it functioning and working today and booting out good science and good products is probably the greatest reward.

Greatest frustration: no work for spouse. The hardest thing for me was that my spouse was unable to acquire a work visa. In 1990, spouses could not get work visas. [Even today in the Philippines, a work permit for a spouse is not automatically given upon application and depends on what kind of work the permit is being requested for.] Paul had a veterinary practice in New York and he had expected to be able to work in the Philippines. He was paying back his student loans and foregoing a normal salary line. He had a skill set that would have been useful. I think the greatest frustration was that he couldn't work and he found it very difficult to develop meaningful professional relationships. That is why the family moved into a "shuttle" research relationship during the last 3 years of my 5-year contract, that is, I traveled back and forth between New York and the Philippines.

Mistaken identity: all Caucasian women look alike. There were just two female internationally recruited staff members at that time at IRRI. It was rare to be female in the scientific arena and my colleague Rebecca Nelson [IRRI molecular plant pathologist, 1989-96] and I were the two females. Other than the fact that we both are Caucasians, we really didn't look alike. She has dark brown eyes; I have blue eyes; she has very curly hair; I have very long straight hair; and during one year she was pregnant. So, about the time she was 9 months' pregnant, walking around with a big belly and her curly hair and brown eyes, and me with my long, straight hair, and no belly, I can remember that many people would see me passing and say, "Hi, Rebecca," and they'd see her passing and say, "Hi, Susan," because, I think, to them we looked very much the same. We laugh about that even today. People still ask me, when I visit IRRI, how is my husband, Johnny? Of course, Johnny is Rebecca's husband and Paul is mine—they still confuse us! That is something we always found very humorous.

National staff make IRRI tick. I think the national staff are what really make IRRI tick. When I first went to IRRI, my learning curve about Asia, about rice, and about many of the things that I now do professionally started with the knowledge that was transmitted to me by the national staff.

Cultivating a loyal "extended" family

I was at IRRI for a relatively short time—really just under 2 years with my family, although I've spent many weeks and months there since that time. I think it was really the foundation of my career. It allowed me to join that "extended" family that IRRI has created over its 50 years and to be a participant both from within and from without.

A great joy has been the interaction with the Filipino staff and the people whom I trained and the many international scholars who came to my lab or whom I've known through my collaborations over the many years. Training people enables one to keep extending the sense of family. People go back to their countries where they continue to work and interact in the international arena. Having participated in an emerging program when molecular breeding technology was just coming on-line really solidified a kind of family bonding that we still enjoy today.

Overall, I believe that this extended family is very loyal to the vision and to the ideal that IRRI represents. So, even if I feel that we need to reinvent ourselves and to reinvent many of our international organizations, I think we all keep somewhere deep within us the vision of what the organization represents, even as it evolves and becomes something new.

Go to www.irri.org/publications/today/McCouch.asp for the full transcript and video clips of Dr. McCouch's interview, in which she also reflects on the challenges of being a female in scientific research; the creation of IRRI's new training course, Rice: research to production; IRRI challenges in 2010 and beyond; and what the future holds, in her view, for packaging better rice varieties for the world's production systems.

IRRI @ 50
1960-2010

IRRI welcomes its alumni to a homecoming party

by **Sophie Clayton**

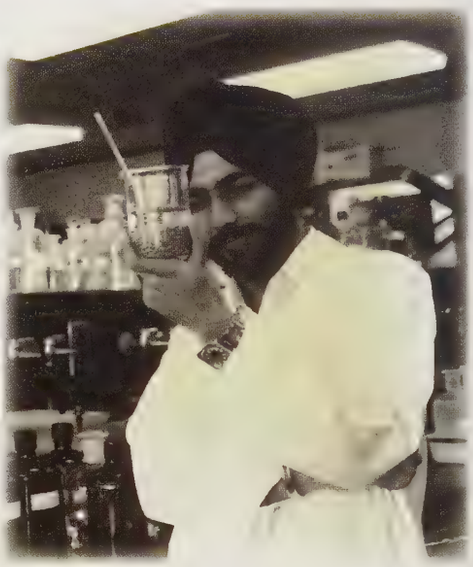
The International Rice Research Institute (IRRI) is hosting (18-26 April 2010) its 50th anniversary alumni homecoming party for all its current and past staff and scholars from the Philippines and around the world.

Since 1960, many thousands of people have worked for IRRI from all corners of the globe. Currently, about 1,300 people work at IRRI. Most are located at the Philippine headquarters, while the rest are grouped into small teams and assigned to country offices.

IRRI's staff members are its most important asset. The Institute recruits science leaders who are considered to be among the best in their fields—and in the world. They are supported by nationally recruited staff that bring their expertise, local knowledge, and skills to IRRI and help connect with the local communities where IRRI works.

Our alumni celebrations are acknowledging the important work of the staff—both past and present. Activities are science forums, the ceremonial harvest of the 138th Long-term Continuous Cropping Experiment, Nostalgia Theatre screenings of historic and contemporary videos about IRRI (see www.irri.org/about/Nostalgia_Theatre.asp), arts and cultural performances, and open houses of IRRI research and support groups covering plant breeding, postharvest technology, crop and environmental sciences, communications, and much more.

The IRRI alumni homecoming was preceded by the 50th annual meeting of IRRI's Board of Trustees, on 12-17 April 2010.



Expanding expertise in rice

Over the past 12 months, IRRI has been experiencing rapid growth. In 2009, more than 200 new employees were appointed and, on average, 17 new people were hired every month. In addition, during this same period, IRRI hired over 260 individuals on short-term contracts and supported 99 on-the-job trainees.

Although the majority of this growth has been based at IRRI headquarters in the Philippines, there has been a rise in the number of staff recruited at IRRI's country offices across Asia and Africa.

In March 2010, IRRI had 74 vacancies to fill. This high volume of recruitment is expected to continue until mid-2010.

Stamps of APPROVAL

by **Gene Hettel**

In honor of the 50th anniversary of the International Rice Research Institute (IRRI), which is based in the Philippines, the Philippine Postal Corporation (PPC) has issued a set of four stamps celebrating the Institute's important work in rice research for the world—much of it done in IRRI's host country.

The four stamps were officially released by Philippine Postmaster General Hector R.R. Villanueva in a special first-day issue ceremony at IRRI's headquarters in Los Baños on 14 April 2010, a date that coincides with IRRI's official birthday as this is when the Board of Trustees first met back in 1960.

According to Elenita D.L. San Diego, acting manager of the PPC's Postal and Philatelic Department, the PPC receives, on average, around 50 requests each year to produce commemorative stamps for various causes, subjects, events, and a variety of organization and celebrity anniversaries, but only around 20–30 can be produced annually. Some of the most recent Philippine stamps feature Philippine marine biodiversity, 90 years of Philippine Rotary Club activities, the 77th birth anniversary of the late former Philippine president Corazon C. Aquino, and now, IRRI's 50th anniversary.

"We were only going to recommend one design to the PPC," said Michael Jackson, IRRI's former director for Program Planning and Communications. "However, our designer came up with so many great studies that we sent four different renderings, all of which were accepted by the PPC!"

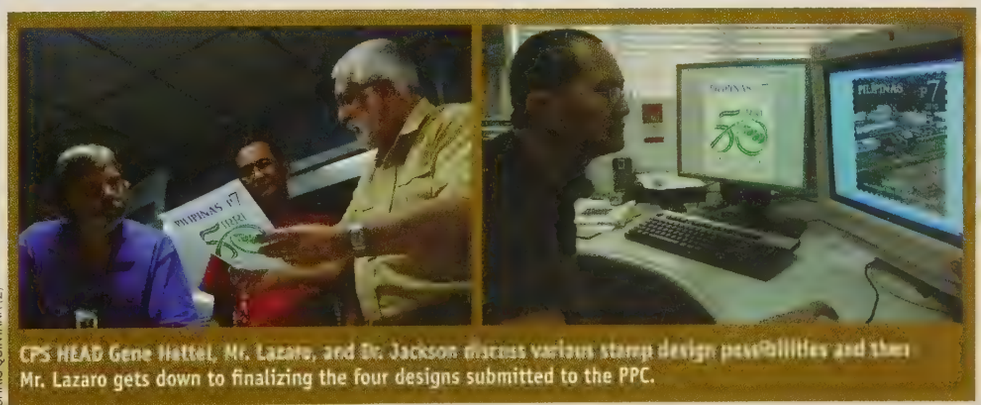
The stamps' designer, Juan V. Lazaro IV, is a self-taught artist who first joined IRRI in 1980 as a laborer in the Plant Pathology Division, working in the field, greenhouse, and laboratory. Now head of the Creative Services Section of IRRI's Communication and Publications Services (CPS) and art director of *Rice Today*, Mr. Lazaro described the elements in the four stamps.

"In the first stamp, I incorporated an illustration of women transplanting rice—depicted as an element in IRRI's original seal and logo introduced in 1961," he said. "The second stamp incorporates a recent aerial photo of the 252-hectare facility located on the main campus of the University of the Philippines at Los Baños, 60 kilometers south of Manila. The third stamp features a recent photo taken in the IRRI field plots and the fourth stamp depicts a representative verdant panicle of a high-yielding rice variety developed by IRRI scientists."

This is not the first time the PPC has recognized IRRI with "stamps of approval." A two-stamp set (above left) was issued on 27 May 1985 to coincide with IRRI's 25th anniversary events.

Stamp collectors and hobbyists can order a souvenir folder, which features the four-stamp set and the official first-day cover on a special envelope with a cancellation postmark dated 14 April 2010, by contacting IRRI's Riceworld Bookstore at RiceworldBookstore@cgiar.org. The cost is US$15 per set while supplies last.

To view an 8-minute YouTube video showing IRRI's rich history in a montage of still photos and the related development of the stamps, go to http://snipurl.com/uvbkg.



CHRIS QUINTANA (2)

CPS HEAD Gene Hettel, Mr. Lazaro, and Dr. Jackson discuss various stamp design possibilities and then Mr. Lazaro gets down to finalizing the four designs submitted to the PPC.

COUNTRY HIGHLIGHT:

IRRI IN THAILAND

Compiled by **Sophie Clayton**

The International Rice Research Institute has had a long-standing relationship with Thailand. The first formal link was made in 1960—the year IRRI was established—when Thailand's Prince Chakrabandhu became a founding member of the IRRI Board of Trustees.

Following this, in 1966, IRRI's Thai office was established in Bangkok with the appointment of the first IRRI scientist assigned to Thailand. During that year, the IRRI variety IR8-288-3 was crossed with tall Thai rice cultivars to produce RD1 and RD3—the first nonglutinous, semidwarf, photoperiod-insensitive, high-yielding varieties released to farmers in the country.

IRRI has maintained a close relationship with Thailand over the last 50 years and, within this period, four Thai scientists have worked at IRRI headquarters. Moreover, between 1966 and 2009, IRRI received 191 scholars from Thailand.

Thailand's royal connection with IRRI has continued throughout the years. In July 1963, His Majesty King Bhumibol Adulyadej (Rama IX) visited IRRI to show his support for the fledgling institute and then, in 1996, he became the first and only Royal Patron of IRRI. Recently, in November 2009, Her Royal Highness Princess Maha Chakri Sirindhorn came to IRRI to launch the Institute's 50th anniversary.

MAP BY NEL GARCIA AND ARNEL RALA

Thailand: fast facts	
Population	67 million[1]
Rice production area	10 million hectares
Total land area	51 million hectares[2]
Average rice yield (2007)	2.97 tons per hectare[3]
Total rice production (2008)	31.7 million tons[3]
Rice exported (2008)	10 million tons (milled equivalent)[3]

[1]World Bank
[2]CIA world fact book
[3]FAO

Rice in Thailand

Rice is the most important crop of Thailand. It occupies about 55% of Thailand's total arable land. Rice is also the staple food of all Thai people, regardless of income.

Thailand is the world's biggest exporter of rice. In 2008, it exported about 10 million tons of rice (milled equivalent), which makes up about 33% of the world rice trade.

If there is anything this country is famous for, it is Thai jasmine rice, a high-quality, long-grain, aromatic white rice, which commands a price advantage over lower grades. According to the Board of Trade of Thailand, the biggest importers of Thai jasmine rice in 2009 were China, the U.S., and Malaysia. Countries such as Singapore, Japan, Nigeria, Senegal, and South Africa have all become major importers of Thailand's many other grades of rice that include Pathumthani rice in whole grain and broken and white rice in parboiled, broken, and glutinous rice. Thailand's rice products cross the wide spectrum of rice available for trade in the world. Interestingly, the country's export rice prices are commonly considered to be the benchmark price for rice products from other nations.

Helping Thai rice production with IRRI science

Some prime examples of IRRI's research targeted at helping rice production in Thailand are pest management research, genetic diversity conservation, the Thai Rice Knowledge Bank, and growing rice in unfavorable environments.

Pest management. Brown planthoppers (BPH) are a major pest in rice fields. In the recent 2009-10 season, BPH have reached plague proportions in Thailand and may cause yield losses of up to 30% in affected paddies.

IRRI helps farmers manage pests in a sustainable way by developing pest-resistant rice varieties, integrated pest management (IPM) strategies, and ecological engineering approaches. IRRI has been monitoring the BPH and associated virus situations across Asia with increasing concern over the past several years.

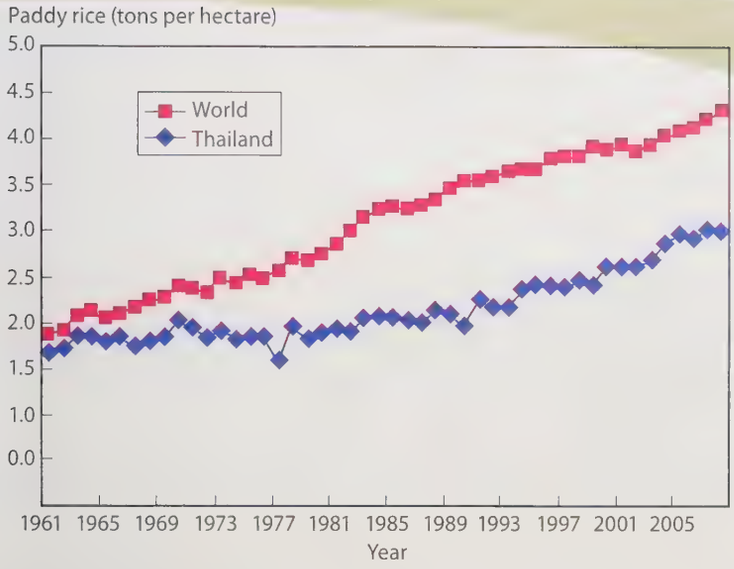
In line with this, IRRI has recommended some practices to reduce the onset and severity of BPH outbreaks such as adopting IPM practices, limiting pesticide use, careful nutrient management, planting resistant varieties, synchronizing rice plantings, and encouraging beneficial insects.

For more information on managing BPH problems and preventing future BPH outbreaks, visit the Ricehopper blog at http://ricehoppers.net/.

Sharing the genetic diversity of rice with Thailand. The International Rice Genebank currently has 5,185 types of rice received from Thailand that are available for sharing under the International Treaty on Plant Genetic Resources for Food and Agriculture. Another 417 are also conserved, but not shared, as requested by Thailand.

Thai rice breeders and farmers can

Average rice yield



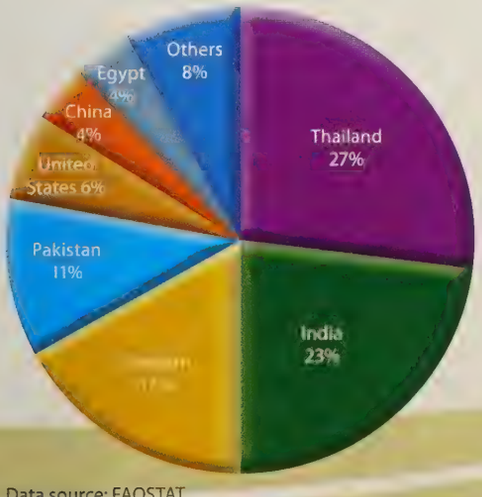
Data source: FAOSTAT

access this rice and other non-Thai rice from the International Rice Genebank's collection of more than 110,000 types of rice. So far, 5,245 different rice samples have been dispatched to Thailand to help breed new rice varieties.

The integrity and uniqueness of Thai jasmine rice will not, however, be compromised through this sharing process because the unique aromatic properties of Thai jasmine rice are a combination of the presence of various aroma genes and the climatic and soil conditions where Thai jasmine rice is grown. Such conditions are not easily replicated outside of Thailand, thus protecting the prestige of Thai rice in the market for many years to come.

Moreover, IRRI scientists have discovered that the version of the major gene for fragrance found in Thai jasmine rice is shared with at least 300 other varieties of aromatic rice from 17 Asian countries. The research suggests that the aroma gene did not originate in Thai jasmine rice.

Percentage of rice export trade by country in 2007



Data source: FAOSTAT

Thai Rice Knowledge Bank. In 2007, Thailand's Rice Department, under the Linking Research and Extension Needs through Information Technology (LEARN-IT) Project, launched the Thai Rice Knowledge Bank (RKB), an online tool that rapidly disseminates current rice production information to extension workers and farmers. The original concept of the Rice Knowledge Bank was developed at IRRI to ensure that farmers quickly and efficiently receive consistent and high-quality rice production knowledge generated from the latest scientific advances.

An evaluation of the Thai RKB showed that extension officers each saved, on average, about US$2,500 a year when they used the RKB. This is based on the time they saved searching for information and revisiting farmers, and the costs they saved on photocopying. More importantly, Thai farmers who used the RKB had fewer costs, higher revenues, and a total net income of $60 per hectare more than non-RKB users.

The evaluation also suggested how to increase the use of RKB information, including encouraging farmers to participate in RKB meetings and improving the general knowledge of farmers about computers. This feedback will be used to further improve the extension of the RKB program (see *Banking our rice knowledge* on pages 36-37 of *Rice Today* Vol. 8, No. 3).

The second version of the Thai RKB is now in use by extension workers in many major rice provinces in Thailand. It has also been reported that some community radio stations in the rice-producing provinces in the north-central and northeast regions of Thailand are using the Thai RKB as a source of new rice technologies and information for broadcasting.

"Rice is the backbone of Thai society and countries of Southeast Asia and therefore its development is tantamount to the development of these countries.

I believe that the work IRRI has done over the years has benefited the well-being of people across the globe, improving their food security and income.

I would like to congratulate IRRI on its anniversary and wish the Institute every success."

Her Royal Highness Princess Maha Chakri Sirindhorn of Thailand, speaking at the launch of IRRI's 50th anniversary on 17 November 2009 (see YouTube video at snipurl.com/v4a2x).

Growing rice in unfavorable environments. Rainfed drought-prone and submergence-prone areas dominate Thailand's rice-growing regions. IRRI has been working with its Thai colleagues to solve rice production problems in these areas for the last 20 years.

As part of the Consortium for Unfavorable Rice Environments (CURE), IRRI and its national agricultural research and extension system partners in Thailand are helping develop drought-tolerant rice and improved management practices for nutrient and weed management.

With Thailand's Rice Department, IRRI is also adapting submergence-tolerant rice to Thai conditions and looking at ways to facilitate adoption and build capacity of local rice breeders and rice scientists. Thai rice breeders have also contributed to IRRI's rainfed rice breeding program by providing the material for rice varieties now used all over Laos.

The global rice crisis hurts South Asia's poor

by **Samarendu Mohanty, Valerien Pede,** and **Alison Zeigler**

We all know what happened to the rice market in late 2007 and early 2008. Within 6 months, global rice prices rose by more than 300%, reaching the unprecedented figure of US$1,000 per ton. Soon afterward, prices retracted; but, unfortunately, they stabilized at a level much higher than before the crisis began in October 2007. For example, the price of 5% broken Thai rice has been hovering between $500 and $600 for the past year and a half compared with the low $300 range during the 2-year period prior to the crisis (Fig. 1). Higher world prices have also been reflected in the rise of domestic retail prices in major rice-consuming countries across Asia and Africa in the past 2 years. Rice retail prices in December 2009 across major retail markets in Asia, except the Hubei market in China, were around 40% higher than what they were before the crisis (Fig. 2). The situation in Africa during the same 2-year period was even worse, as the retail price increased by 40–80% in most countries, except in Mogadishu, Somalia, where it exceeded 100%. Still, this has happened despite measures taken by countries around the world to insulate domestic markets from world market instability.

Fig. 1. Price of 5% broken Thai rice (March 1998 to January 2010). Source of raw data: The Pinksheet, World Bank.

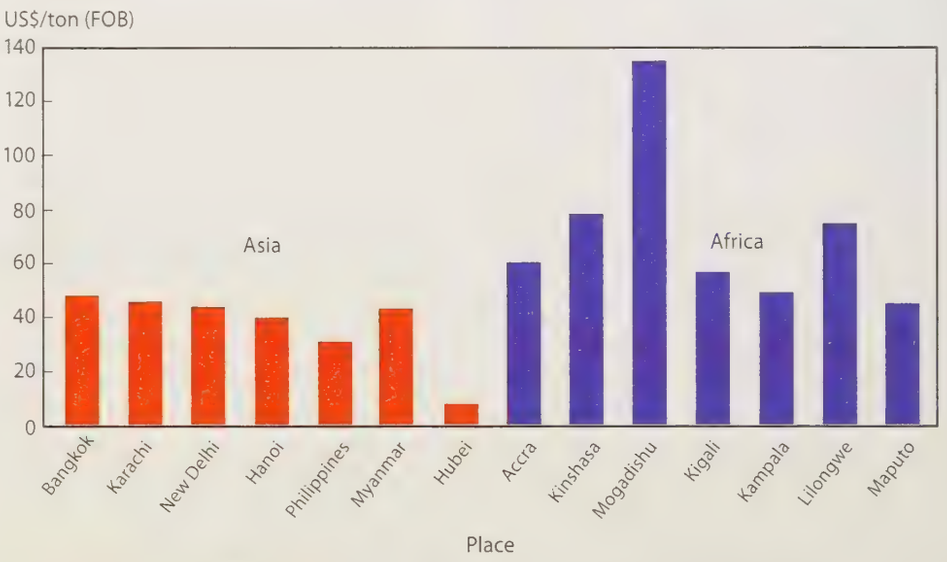


Fig. 2. Change in rice retail prices (December 2009 vs two years earlier). Data source: FAO Rice Monitor (12-2009).

The case of South Asia

Major rice-consuming countries in South Asia such as India and Bangladesh had also taken measures at the onset of the global rice crisis to protect their domestic markets. Despite such measures, domestic rice retail prices in these two countries' major markets (Fig. 3) have increased significantly since the beginning of the crisis.

In the case of India, high food price inflation in rice, sugar, and lentils has, in recent months, become a regular front-page news story in leading Indian newspapers. Rice prices in major retail markets have been rising steadily since the start of 2008 and current prices are more than 50% higher than 2 years ago.

In Bangladesh, rice prices rose and fell in late 2007 and 2008, following the trends in the global market, but prices have started to rise again in the last 6 months. According to an article in the 15 February 2010 issue of *Star Business,* a Bangladeshi newspaper, rice prices have increased by as much as 37% since the beginning of the current fiscal year (1 July 2009).

In order to assess first-hand how people in farming communities cope with rising rice prices, we conducted a short survey in parts of India and Bangladesh during our recent trip to South Asia in February 2010.

A snapshot of India

Our first stop was the district of Kushinagar in eastern Uttar Pradesh. We visited a few villages to conduct a focus group discussion and pretest our village survey questionnaire as part of the Cereal Systems Initiative for South Asia project funded by the Bill & Melinda Gates Foundation. We took this opportunity to interview various farmers, including marginal farmers and landless laborers, regarding the impacts of the rice price hike. The questionnaire was designed

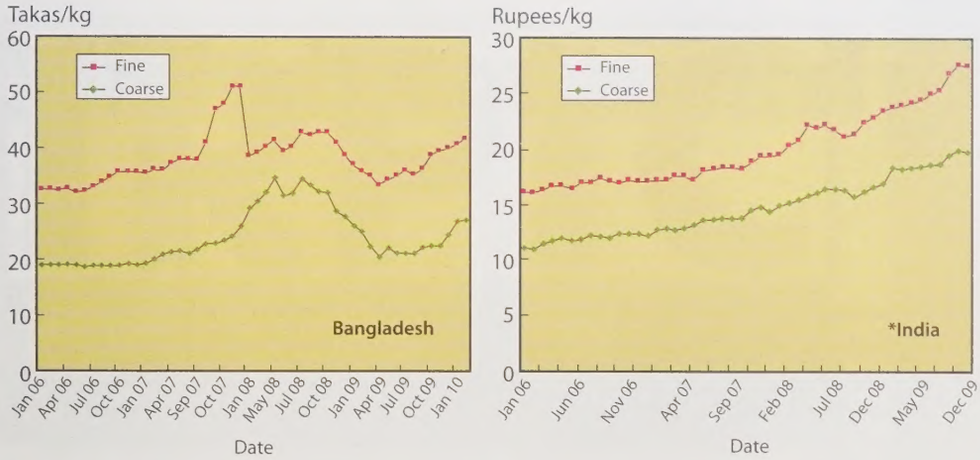


Fig. 3. South Asia rice retail prices. Data source: Bangladesh Directorate of Agricultural Marketing.
*Average for major Indian markets. Data source: Indian Ministry of Agriculture and Cooperation.

to investigate the various adjustments these categories of farmers have to make with regard to food consumption and expenditures, and on-farm and off-farm activities, in response to rising rice prices.

Our survey showed that most farmers are aware that rice prices have gone up in the last year, but only marginal and landless laborers with large families seem to have been affected by such price increases. Farmers who produce enough rice for their own consumption seem to have not been affected by the recent price rise. This includes farmers of all types whose own production is large enough to meet their year-round needs. In those villages, marginal and landless laborers, who fall below the poverty line, are also not affected by higher prices because rice and wheat were heavily subsidized by the Public Distribution System (PDS). Very few landless laborers with large families, who needed more than the monthly allotment of 35 kilograms of grains (rice and wheat) from the PDS, seem to have been affected by higher rice prices. All of those who said they buy rice from the market admitted that they have cut their other expenses, including the purchase of other food items, to maintain rice consumption.

Our next stop brought us to a village in Maharajgang District of Uttar Pradesh, located near the Nepal border. We also spoke to a group of farmers, which included a number of marginal and landless women laborers.

According to these marginal and landless women laborers, rising rice prices have severely affected their food consumption pattern because of the non-availability of PDS grains. They have spent less on other food items such as pulses, meat, and milk to maintain rice consumption at the precrisis level. In addition, some of them have been working extra hours to earn more and keep their food consumption pattern unchanged.

After this, we headed to the eastern coastal state of Orissa, and stopped at a progressive village named Nuapada in Jajpur District. The story was more or less the same as in the villages in eastern Uttar Pradesh. People with sufficient land to feed their own family are hardly affected by higher rice prices, whereas marginal and landless laborers with small families were protected by the PDS program. The real impact of the rice crisis was felt by landless laborers and marginal farmers, whose need extended beyond what was obtained from the PDS.

This story didn't change much during our visit to a fishing village in Kendrapada District and to another village in Khurda District near the capital city of Bhubaneswar. The overall picture in India didn't vary much as we moved across villages in these two states. The PDS is definitely acting as a buffer for the most vulnerable section of society against such price fluctuations.

A quick look at Bangladesh

On our next stop in neighboring Bangladesh, we visited a few villages in Kishoreganj District of Dhaka Division, situated in the northeastern region of the country. The situation in those villages appeared to be different from those in India. As indicated earlier, rice prices in the country have been rising in the last several months after staying relatively low for the first half of 2009. Like the farmers in India, Bangladeshi farmers who have enough resources to produce sufficient rice for their own consumption seem to have been unaffected by the crisis. But, small, marginal, and landless laborers have started to feel the pinch of rising rice prices. Some families obtain 5 kilograms of rice twice a month at 22 takas (US$0.32) per kilogram, but, for many, the price difference is too small and the quantity is not enough to meet their needs. Similar to their Indian counterpart, this group also overwhelmingly agreed that their rice consumption has not changed despite higher prices. However, coping mechanisms differ from person to person. Some work extra hours to earn additional income, while others try to reduce their expenses on other items, including high-value food items such as meat and fish, to keep their rice consumption unchanged.

What have we learned?

Generally, a country is not insulated from the happenings in the global rice market. Interventions in the domestic and trade sectors may protect against short-term fluctuations in world prices but, eventually, the domestic market is influenced by global price changes. In the case of Bangladesh and India, domestic retail prices are higher than the prices 2 years ago despite several measures taken by their respective governments to keep prices low. For these two South Asian neighbors, rice continues to occupy a central place in the rural food basket. It is also worrisome that price rises have a direct impact on the most vulnerable in society—marginal farmers and landless laborers.

Government programs such as the PDS definitely play an important role in protecting the rural poor against price escalation, but they do not necessarily cushion everyone from the ill effects. These programs, though important from a national food security perspective, are significant burdens on government coffers and may not be effective if the system is not clean. The bottom line is that these programs may provide temporary relief against price escalation, but they are not a long-term solution. The long-term food security problem can be solved only by keeping rice affordable by expanding production primarily through yield improvements.

Mr. Pede is a scientist in IRRI's Social Sciences Division and Ms. Zeigler currently works as an intern in the same area.

Learning lessons from the HRDC

BY FANGMING XIE

The Hybrid Rice Development Consortium (HRDC) was established at the International Rice Research Institute (IRRI) in 2008 with 38 public and private organizations. Its membership then expanded to 47 organizations in 2009 as it aimed to renew and strengthen the collaboration between the private and the public sector and to enhance the dissemination of hybrid rice technology.

This technology has been used as a key tool in increasing rice production and productivity since the 1970s. The area covered by hybrid rice in 2008 reached 20 million hectares globally, including 3 million hectares in countries outside China. IRRI, collaborating with public and private partners, has contributed significantly to the research and development of hybrid rice in the tropics—providing many research findings, technical support, and germplasm and hybrids for breeding and release.

Hybrid rice research began in public institutes, as it was essential to provide basic scientific information and know-how on the technology, adoption, economics, and policy support. As the technology advanced, private enterprises became more involved in all aspects of hybrid rice research and development; they even invested in hybrid rice seed businesses. The shift of hybrid rice from academic research to commercialization requires a close partnership between the public and the private sector to enhance the steady stream of innovation and research outputs, and to improve product accessibility and commercial use ultimately by rice farmers. The private sector in the seed industry has a comparative advantage in large-scale commercial production, seed processing, and marketing—areas in which IRRI and public institutes have no direct involvement. However, the public sector has expertise in scientific research, product assessment, germplasm development, technology dissemination, and capacity building. To combine these complementary advantages is beneficial to both parties and encouraging private-sector involvement is critical in ensuring the sustainable growth of hybrid rice.

Through the HRDC, IRRI contributes in three areas: (1) enhanced research on specific traits of hybrid rice, such as increasing yield and increased and stable yield of seed production, improved resistances to stresses, and improved grain quality; (2) improved germplasm/hybrids that have diverse genetic background and that have been evaluated by network organizations around the world; and (3) better information and capacity building, including the best management practices to realize high yield potential, germplasm/hybrid evaluation, molecular technology application, and other advanced research related to rice.

During the past years, HRDC members have met annually to review the progress of hybrid rice at IRRI. They identified and validated common issues challenging the research and development of hybrid rice and the constraints that limited public-private partnership. As a result of these evaluations, the members developed a new transparent mechanism to improve their collaboration. They discussed priorities and identified areas that urgently needed to be improved. Recognizing the importance of accessing IRRI's hybrid rice products and information, IRRI's hybrid rice program has taken a product-oriented approach to focus more on product development and delivery.

The HRDC has built a regional hybrid testing network to assess its members' hybrid rice in varying environments across the different countries and locations. Member breeders are invited to participate in selection for hybrid rice breeding lines developed at IRRI—and these lines can be further evaluated in members' environments and then integrated into their own breeding programs.

The HRDC believes that members can speed up research on hybrid rice if they can all pool together the resources gathered from the private and public sector. This would allow them to form strong support and an endowment that would result in the development of a wider range of hybrid products—from which the general public could also considerably benefit.

The HRDC significantly enhances the capacity for hybrid rice research at IRRI and also works to boost product delivery with improved hybrid rice germplasm, research output, information, and training. The public sector benefits from the collaboration by actively participating in the research and development: learning the needs of the seed market and adjusting research activities. Farmers, however, benefit the most from the improved pipeline for product development because they can avail of more and better rice hybrids that can increase rice productivity at reduced costs.

It is important to note that the HRDC, which is hosted at IRRI, is not a competitor of private enterprises in the seed market. Its role is to provide research services and support to both the public and private sector. The consortium endeavors to establish a new public-private partnership model that will maximize the use of modern agricultural technology to produce hybrid rice and make an impact on rice production.

Successful partnerships between the private and the public sector can prove to be the key to making research programs sustainable. This would create clear accountability among partner organizations, and allow all parties to capitalize on each organization's strengths. Drawing lessons from the HRDC's experience could serve well in building new public-private partnerships for seed-based technologies in the future.

Dr. Xie is a hybrid rice breeder in IRRI's Plant Breeding, Genetics, and Biotechnology Division. He is currently the coordinator of HRDC. See the HRDC Web site at http://hrdc.irri.org

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